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Vol. V. NEW YORK, MARCH 28, 1885. No. 13.

Handsomely bound volumes of THE ELECTRICAL WORLD *for* 1884 *are now ready, and will be sent, charges prepaid, to any address on receipt of* $5.00.

WE understand that the extension of the Associated Press service in the West requires about two thousand miles of wire.

THE American baronet, Sir Curtius Miranda Lampson, whose death in England we noticed in our last issue, was the inventor of a very ingenious method of applying electricity to the preparation of seal-skins. The skin is "fed" over a knife-edge bar, above which is stretched a fine platinum wire, which, raised to a white heat by an electric current, meets the longer hairs, which rise above the under fur, and mows them down.

OBJECTION to the extensive street opening work that would be required in order to put all the electric wires underground this summer in New York, is offered on the score that it would assist in the spread of a cholera epidemic, or even invite an outbreak of the dread disease. This is far from being one of the most valid objections to wholesale removal of aerial wires, but the state of the city streets certainly encourages the idea that burying the wires this year might lead to burying most of the people, too.

THE famous Palais Royal, of Paris, has of late years sunk somewhat into dilapidation and decay. But the proprietors of the stores in it, desirous of making it once again a favorite promenade, have formed a syndicate to increase its attractions, and the very first thing they have resolved upon is to illuminate it throughout by electricity. The installation will comprise the open square, the galleries, and the stores. Special interest attaches to this more from the fact that it will give Paris its first central electric light station.

NOT long ago, the Sacred Congregation of Rites, in Rome, issued an authoritative document to the effect that electric lights were too profane for use in Christian temples. But all religious authorities do not share the opinion of the Congregation. In this country, the electric light is used in several churches, notably the Congregational Tabernacle on Broadway, this city, and in England it is now proposed to apply the electric light to the illumination of Canterbury Cathedral. The installation will probably be ready in a few months.

KANSAS CITY is remarkably progressive, and hence it happens that the attention of the people there is at present largely occupied with electric locomotion for the street cars and a pneumatic transportation scheme for parcels, messages and small freight. The Van Depoele system is to be used for ten miles of car-track in the city, and a Mr. Henry is offering another electric motor system for public support. The tube system is known as the Brisbane, and, as usual, some modest claims are made for it.

ROYAL patronage is held to be "a good card" in England, and all over monarchical Europe, so that when the favor of royalty is bestowed on a person or object asking support and recognition from the public, the chances of success are vastly improved. Hence it is natural that the appointment of Mr. W. H. Massey as mechanical and electric light engineer to Queen Victoria is hailed with much pleasure on the other side. The London *Electrician* says that "the importance of this appointment as an official recognition of the desirability of establishing such an office is undeniably great." Mr. Massey supervised and carried out successfully the electric lighting experiments made at Windsor Castle and Buckingham Palace last year.

REMEMBRANCE of the grand success scored by the Electrical Exhibition at Philadelphia, last fall, under the auspices of the Franklin Institute, will give electricians additional interest in the "Novelty Exhibition" which, under the same auspices, will open in Philadelphia on Sept. 15 next. Whatever the Franklin Institute does it does well, and as the "Novelty" will, of course, be wider in its scope and of broader interest, we shall look for far greater success even than that reached by the "Electrical." The promised display is to be similar to the approaching exhibition of inventions in London, and, as it is not confined exclusively to any one class of inventions, there can be no doubt of its overwhelming success.

IT appears that there are upward of six hundred local electric lighting companies in this country and Canada. If to the arc and incandescent lamps run by these companies could be added the lamps belonging to isolated plants and private persons and institutions, some adequate notion might be formed of the rapid advance of electric lighting and of its solid basis. All Europe cannot show figures to match those of the United States in the department of public lighting. One field in which greater development has been made in Europe is that of ship lighting, for the reason that Europe has more ships than America of the sea-going class. Another field is that of installations in miniature for city dwelling-houses and country residences.

THE Supreme Court of Minnesota holds that the notice on Western Union blanks, stipulating with the sender of a message that all claims for damage, to be valid, must be presented in writing thirty days after its dispatch, is a reasonable one, and that the sender is bound by it as part of his contract. It is not a regulation intended to shield the company from the consequences of neglect of duty, but prescribes a duty to be performed by the sender before he can be entitled to maintain his action against the company. By means of such timely notice, the company can ascertain the facts in the case and secure or preserve the evidence in regard to it. If claims could be brought at any time, the door would be opened to many attempts at fleecing the company. On broad grounds, the decision is proper.

ARGUMENTS for and against the proposed horse-cars for Broadway are still being heard with patient fortitude by the General Term of the Supreme Court. It will be remembered that the commissioners reported in favor of a street surface railway, but all the ground has to be gone over again, on account of the determined civic and private opposition offered to the confirmation by the court of their report. We trust that soon all parties interested will settle down to the conviction that an underground road would be best, though this unanimity is almost too much to hope for. What is wanted is a plan that will keep Broadway free from car tracks, and yet help in relieving the elevated roads, now congested beyond endurance morning and night; and, as no one dreams of allowing the erection of elevated roads on Broadway, the underground road is the only solution of the difficulty. Travel in New York is increasing at a tremendous pace. The total number of passengers carried on all railway and car lines in 1877 was not quite 164,000,000; and in 1884 it was 284,000,000. At the present time the travel on the elevated roads is over 100,000,000 passengers annually, and the growth between 1883 and 1884 was nearly 16,000,000. By far the largest proportion of the travel is up and down town during the morning and evening, and nothing is plainer than that in a very short time the rapid transit facilities will be utterly inadequate in the normally busy hours. But a service in Broadway would lessen, if not remove, the strain, and afford greater conveniences to a large number of citizens. If the underground road were operated by electricity, it would be safe, clean and healthy, would afford needed facilities, and pay handsomely.

SOME amusement has been afforded the New York newspapers by the refusal of an electric light customer here to pay his bill, on the ground that he had not used any lamps. The Edison meter showed, or was said to show, that he had taken so much current, and he was therefore charged such and such a sum for it. One facetious journalist says: "It would be interesting to know if the particular electric meter which made a false charge of $9.29 had ever been associated with a gas meter. If it had spent any time in a cellar in the society of a gas meter it was quite possible that it was corrupted by the vicious influence and degrading example of the latter. That the gas meter does exert a most demoralizing influence upon those who associate with it is sufficiently proved by the character of the managers of gas companies, not one of whom ever declines to profit by the false testimony of meters. Persons using the electric light cannot be too careful to remove their gas meters from the cellar before introducing the electric meter. The probability is that the electric meter is honest when left to itself, but that it is weak and easily led away by bad companions. If, on the other hand, it should turn out that the electric meter is as inherently vicious as the gas meter, the electric light will become as unpopular as gaslight, and the public will burn nothing but oil and candles." The desideratum of which we spoke last January—a simple self-registering meter that will show the suspicious consumer, at any time, the amount of light, or current, that he has used—has yet to be supplied. Though the meters in use may conform to the requirements of scientific principles and are accurate in their work, they remain under the control and manipulation of the lighting company; and after years of sad experience with that successful example of perpetual motion, the gas meter, the consumer has become skeptical as to every other form of measurement of light.

INCREDIBLE stories have long had currency as to the rapidity with which communication can be made without the aid of the electric telegraph. Asiatics are credited with the ability to expedite news with an accuracy and a celerity that leave the most carefully devised mail agencies of their European invaders hopelessly beaten, and yet up to the present time no one has revealed the use or employment by Asiatics of special means of correspondence. It does not appear that carrier pigeons are employed by them to convey intelligence; nor are foot messengers so remarkably swift as to excel records familiar in Europe and America. If the means are narrowed down to swift dromedaries or horses, we get at some definite idea as to the ground that can be covered in a day by special couriers; and if we allow two hundred and fifty miles a day, it will be seen that the rate at which news travels in the East is not far in excess of that at which the contestants traveled in the roller skating contest in this city recently. The French government have been making experiments in Algeria with the view of obtaining data on this interesting and important subject, and it is said that they got a speed with couriers of not quite two hundred and fifty miles to the day. We have grave doubts as to the trustworthiness of the tales now afloat about the rapid transmission of news in Egypt by the Arabs during the present war. Any one who has lived in the East or in tropical regions knows that the merest peasant or laborer there can outdo any Western reporter in exaggeration, and that it is only with the utmost difficulty that precise information on any subject can be obtained. The government of India may have been second in getting news at the time of the native rebellion, and the news from Egypt may have reached Mecca or Alexandria before it was given to London; but the Asiatic governments, which ought to know something about the matter, are all getting the electric telegraph as quickly as they can, for themselves, if not for their people.

The Spark of Induction Coils.

In a paper lately brought before the French Academy, says the London *Electrician*, M. Eugéne Demarçay points out certain modifications with the induction coil, for rendering its use easier and more practical in spectral analysis. The source of light universally used is the spark of very high potential, from a coil with a long and fine induction wire. This special construction is necessary in the case of M. Lecocq's experiments, owing to the fact that the liquid opposes a resistance impossible to overcome in the case of sparks with a slight potential. Employed in its original state, this spark does not afford spectra capable of being utilized for bodies when it is desirable that they should have no appreciable chemical reaction. Moreover, the great part of those who have wished to obtain bands for these bodies have had recourse to the same induction coil by adding to it a condensing battery of greater or less power. Besides, it cannot be dispensed with when metallic electrodes of short interpolar distances are used to produce spectra, the spark otherwise becoming quite insignificant. But a considerable drawback to this process arises from the presence in the spectrum of secondary bands from the air and of bands from the electrodes. The spectrum of the air especially has a brightness much greater than that of the metallic bands present. This drawback, added to the separation necessitated by the spectrum of the electrodes, renders long and difficult an examination which, if it is not rapid and simple, is without practical value for the chemist. All these difficulties disappear at once, and a spark is obtained which gives no trace of secondary bands of the air and rarely slight traces of nebulous primary bands of nitrogen and bands of the electrodes, by using the spark of a coil with thick and short induction wire. This spark has a temperature sufficiently high to easily give spectra of all the elements known. The coil constructed for this purpose yields a spark of 5 millimetres only, under the action of a battery of 6 or 9 bichromate elements (zincs, 10 by 16 centimetres), two or three in surface and three in series.

FIG. 1.

The coil has 115 centimetres in internal diameter, and a length of 23 centimetres. The induction wire, 1 millimetre in diameter, weighs 1.32 kilogramme, and is wound on two ranges. The induced wire, 1 millimetre in diameter, weighs 3.4 kilogrammes. The bundle of soft iron wire, 27 millimetres in diameter, weighs 680 grammes. Lastly, the condenser of the inducing current is threefold that of the condenser usually placed on such coils. It should still be insufficient, because the spark of the extra current is very appreciable. The spark produced is 5 millimetres long; and its aureola, at least 3 millimetres for 6 elements, is almost silent, and becomes brilliant when sufficiently shortened. It gives with brilliancy, especially when short, the spectrum of the electrodes, and traces, scarcely visible, of the primary nebulous bands of the air, which even disappear entirely in most cases.

The Advance of the Van Depoele System.

The Van Depoele Company have made the following installations: Illinois—Elgin, 80 lights; Freeport, 40 lights; Lincoln, 40 lights; Rock Island, 6 lights; Kankakee, 3 lights; Rockford, 66 lights; Dixon, 30 lights; Sterling, 30 lights; Joliet, 60 lights; Bloomington, 40 lights; Streator, 70 lights; Jacksonville, 40 lights. Michigan—Detroit, 70 lights; St. Joseph, 30 lights; Lansing, 40 lights; Flint, 60 lights; Jackson, 80 lights; Ann Arbo lights; Adrian, 10 lights. Iowa—Cedar Rapids, 60 lights; Decorah, 30 lights; Burlington, 40 lights; Dubuque, 6 lights; Muscatine, 30 lights. Dakota—Sioux Falls, 30 lights; Bismarck, 8 lights. Missouri—Springfield, 60 lights. Minnesota—Crookston, 30 lights; Moorhead, 40 lights; Winona, 53 lights. Indiana—Notre Dame, 24 lights; La Porte, 30 lights. Wisconsin—Wausau, 8 lights; Milwaukee Ex., 20 lights; Antigo, 10 lights. Arkansas—Little Rock, 7 lights; Fort Smith, 60 lights. Philadelphia, Pa., 52 lights; San Francisco, Cal., 100 lights; Cleveland, O., 10 lights; Buffalo, N. Y., 10 lights; Beatrice, Neb., 30 lights. Chicago—Home Van D. E. L. Co., 100 lights; "Nee Ban," 30 lights; "Battle of Gettysburg," 20 lights; McCoy's Hotel, 6 lights; C. E. Rector, 10 lights; Leroy Payne, 16 lights; Sherman House, 20 lights; A. Plamondin, 20 lights; "Tivoli," 10 lights; Pitkin, Vaughn & Co., 10 lights; Abbott Buggy Co., 10 lights; J. V. Farwell & Co., 65 lights; Carson, Pirie, Scott & Co., 20 lights; Chicago Museum, 10 lights; Sea & Co., 20 lights; Tobey Furniture Co., 20 lights; B. F. Norris & Co., 6 lights; Clifton House, 20 lights; Thorne Wire Hedge Co., 16 lights; Brand's Brewery, 10 lights. Ontario—Toronto, 100 lights. The company have also lately put a plant on the railroad bridge across the river at Little Rock, Ark.

This makes a total of over 2,000 lamps sent out by this company, and now in successful use.

The Van Depoele Electric Motor.

At the International Electrical Exhibition, held in Philadelphia last year, the Van Depoele Company exhibited, among other apparatus, a new motor, intended for light work, such as running dental lathes, sewing machines, fans and the like, and it attracted general attention. The few machines on view were speedily disposed of, and the inquiry since that time has induced the company to form a separate department in their shops for the manufacture solely of motors.

We illustrate on this page the three leading types now made by the Van Depoele Company. Fig. 1 shows the small motor for light work. The principle of construction will be easily seen from the cut. The ring armature has numerous sections, insuring steady motion, and the pole pieces are of special form. The design of the whole is simple and symmetric; there are no parts to get out of order, and with a few drops of oil occasionally, these motors will run for years without the slightest irregularity, and without perceptible wear. The battery furnished with them is a bichromate, of improved pattern, which can, of course, be connected or disconnected with the motor at will by means of a switch, and can be put away in any convenient place in a box.

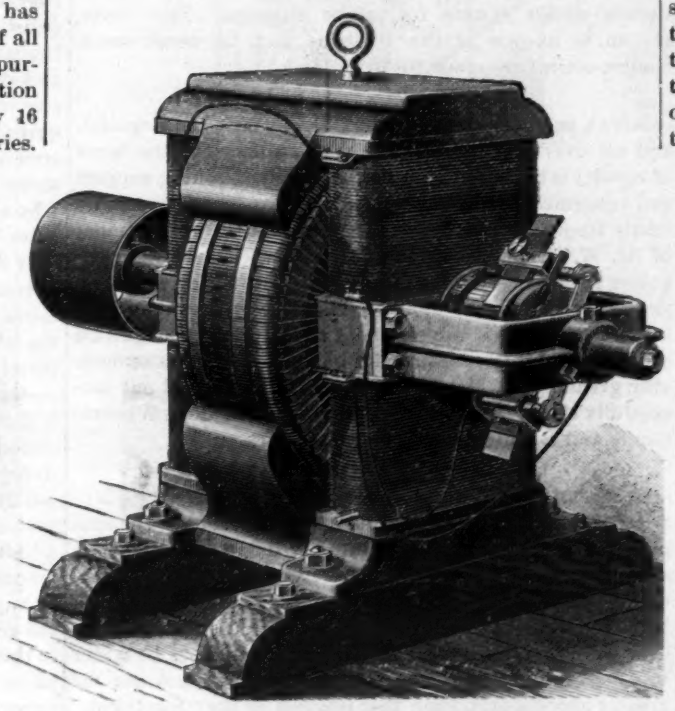


FIG. 2.

It is only a question of time when large electric motors will be generally introduced, the current being furnished from central stations or else from the utilization of natural power now running to waste. In large cities, where hundreds of small steam engines are now in use, each of which requires firing and attendance, the electric motor will be of the greatest utility, its great features of recommendation being that it generates no heat, needs scarcely any care the year round, makes little noise, is ready to start at a turn of the switch, keeps up a steady motion, and is under perfect control. Beyond the use of the motor in factories, mills and industrial establishments of all kinds, there is the other important field in which it must take a leading place—that of the propulsion of cars on elevated and surface railways and even railways running for miles across country.

A machine for all this varied work is shown in Fig. 2, taken from a 50 horse-power motor, on which some very interesting and satisfactory tests are being made now, the results whereof will be reported later in these columns. It will be noticed that this type of motor differs entirely in construction from the regular dynamo or generator made by the Van Depoele Company, illustrated and described in our issue of September 27, 1884. The details of construction we hope to give hereafter.

Fig. 3 is a motor for running large horizontal fans, which can be coupled directly with the vertical shaft. When it is necessary to run several fans at once, instead of using several motors, one motor of sufficient power for the lot can be used, with the intervention of belting in the ordinary way.

The Van Depoele motor has already gone triumphantly through several trials. It was used with great success on the electrical railway at Toronto, Can., last year, and is now to be employed on ten miles of street car lines at Kansas City.

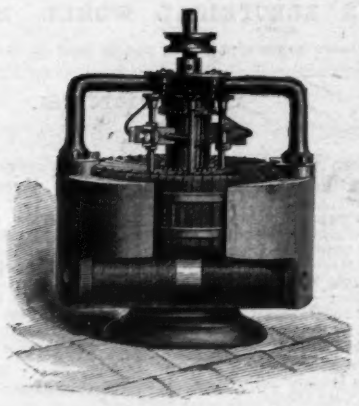


FIG. 3.

Press Contracts.

The summing up of counsel in the action brought by James H. Goodsell against the Western Union Telegraph Company to recover about $682,000, with interest from June, 1882, amount claimed to be due on a contract and damages for violating the same, was begun on March 24 before the referee, James C. Spencer. Melville Egleston appeared for the defendants and George W. Miller for Mr. Goodsell. The contract on which the action is based was made between the National Associated Press, James H. Goodsell, president, and the Atlantic & Pacific Telegraph Company, whereby the latter was to supply certain papers with news prepared by the Press Association at fixed rates, making a maximum yearly compensation of $50,000. A few weeks after the contract was signed, in 1881, the Atlantic & Pacific Company was absorbed by the Western Union. In March, 1882, the Western Union refused to transmit the news without increased compensation, causing the collapse of the Press Assocation and the alleged damages. About $32,000 of the sum is claimed to have been due the Press Association, collected by the Western Union and withheld by it.

Mr. Egleston argued that the contract itself was illegal and invalid. It did not purport to have been made with the plaintiff. It was not entered into by the Western Union, was never consented to by that company, and might have been repudiated at any time. But assuming that Mr. Goodsell was entitled to its benefits, the charges made by the company against the plaintiff for excess of service, special services and services for places not mentioned in the schedule accompanying the contract, made the amount to be charged against him $1,000 in excess of the balance of collections in the hands of the telegraph company. There was no doubt but that in March, 1882, the defendants wished to change the rates, and so informed the plaintiff. He made no objection and went on just as before until he sold out in the following June to the United Press Association. After that Mr. Goodsell made no attempt to go on with the business, and that he should ask for damages was absurd. Not one word of testimony had been adduced showing that the increased rates asked by the Western Union led to the formation of the United Press Association. That was organized because Mr. Goodsell's service had been unsatisfactory. There had been no such thing as the National Associated Press. There was no company at all. Mr. Goodsell had called himself president when he alone were interested and took all the profits. There were no stockholders and no officers. If Mr. Goodsell did not come within the letter of the statute against using fictitious names he certainly came within its spirit.

A New Field for Chiffonniers.

"There goes the man who lives on t' raph wires," said the Signal Service operator at Philad nia, pointing to a seedy-looking individual who was emerging from the room with a doleful face.

"What!" exclaimed the astonished reporter. "Does he eat them?"

The operator laughed. "No," he replied, "he picks 'em up and sells 'em. After every storm the streets are full of bits of wire that have blown down. The man who just went out collects and sells them to fence manufacturers and blacksmiths, who utilize them in some way or other."

"What do you think he was up here for?" asked the sprightly clerk of the weather.

"Give it up."

"Well, I thought you would. He actually climbed up to my sanctum to ask if there was any hope of a tornado or cyclone striking Philadelphia. He says the game pays so well that when the next storm is prophesied he is going to employ some Italians to help him. That is why he wants advance notice. He told me he was opposed to the underground electric conduits."

The Thomson-Houston Dynamo-Electric Machine.

Considerable attention is being bestowed just now upon the Thomson-Houston system of electric lighting, by the electricians of Europe, where it has hitherto been less known than its distinctive features and special merits would warrant. One of the latest writers upon it is M. Guerout,

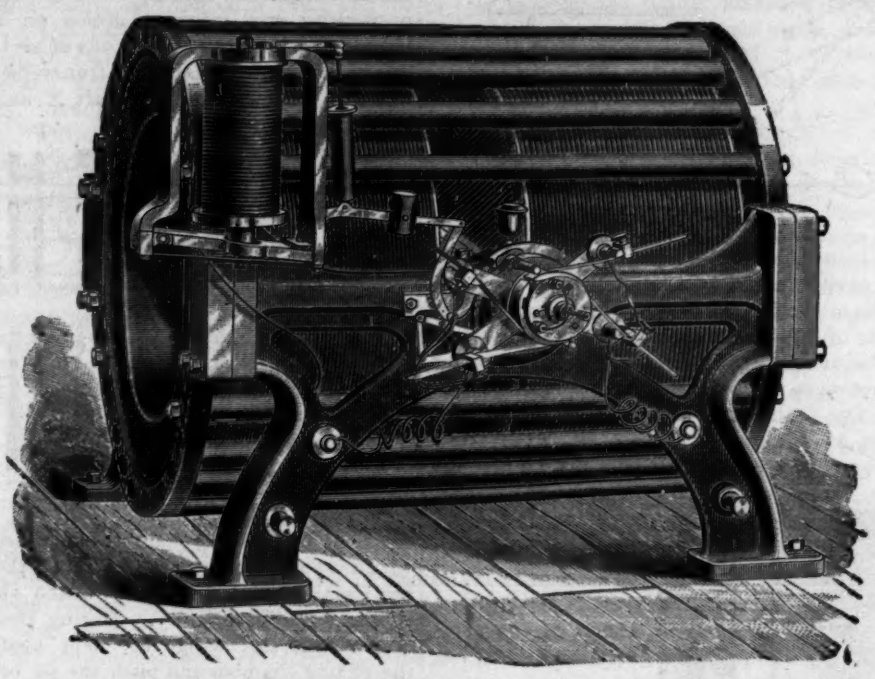


FIG. 1.

whose articles in *La Lumière Electrique* are always of a valuable and interesting nature. His description of the dynamo is so clear, and at the same time takes in so many points of importance, that we have ventured to translate it, reproducing also the cuts, in the belief that a great many of our readers will welcome fuller information on a subject about which, even in this country, there has been misconception, and where the rapid commercial development of the system has rendered precise, minute knowledge of it desirable.

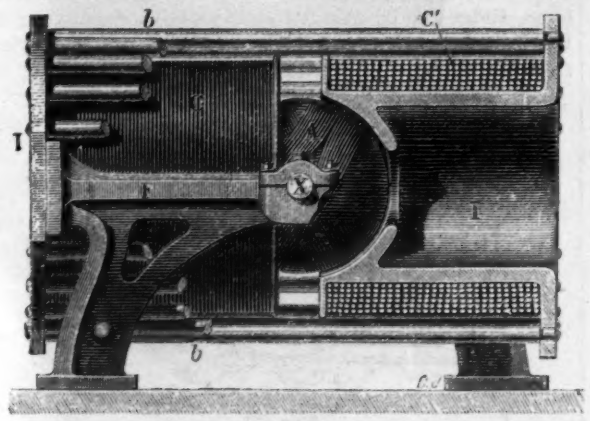


FIG. 2.

Fig. 1 is a perspective view of the machine, and Fig. 2 shows some of the parts in section. The field magnets consist of two hollow cylinders, which are supported by a frame *F F*, which also carries the bearings for the armature shaft. The inner end of each cylinder is formed by a spherical cap having an opening in the centre, and

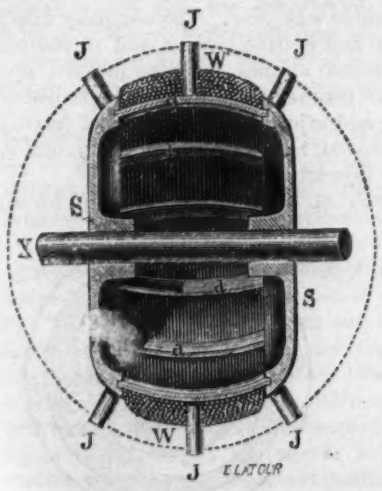


FIG. 3.

the two are brought together, so as to leave a spherical space in which the armature revolves. At their outer ends the cylinders are flanged and form the annular plates shown. These plates are connected by the iron bars *b b*, which unite them magnetically, and at the same time act as a protection for the wire *C*, wound around the cylinders.

The magnetic field generated by these means is spherical in form, and is consequently occupied by an armature similarly shaped. This armature consists of only three bobbins of wire wound around a core of iron resembling in form an ellipsoid of revolution. The ellipsoid is built up of two concave plates *S S*, Fig. 3, fixed on the shaft, and the edges of which are bridged over by light iron cross-pieces *d d*. On these cross-pieces there is wound a certain quantity of iron wire which is oxidized and varnished so as to insulate the various layers; wooden pins *J J J* are inserted in the edges of the plates *S S*, which act as guides for winding the bobbins. The latter are wound at angles of 120° relatively to one another, and in the manner shown in Fig. 4, in which each bobbin is reduced to a single turn of wire. It will be noticed that the three entering wires are joined together at *h*, whereas the three outgoing wires have their ends joined to the three equal segments of the commutator.

When the armature, shown complete in Fig. 5, is to be wound, the core is first covered with thick paper which is made to adhere by a varnish of gum lac. Then, commencing at *h*, one-half of the first bobbin is wound; the core is then turned 120° and one-half of the second bobbin is wound. The third bobbin is also commenced at *h*, but is wound full length. Next the second half of the second bobbin, and finally that of the first bobbin, are completed, over the surfaces corresponding to their first halves. The inner ends of the wires are connected at *h*, as stated above, and the external ends are carried to the sections of the

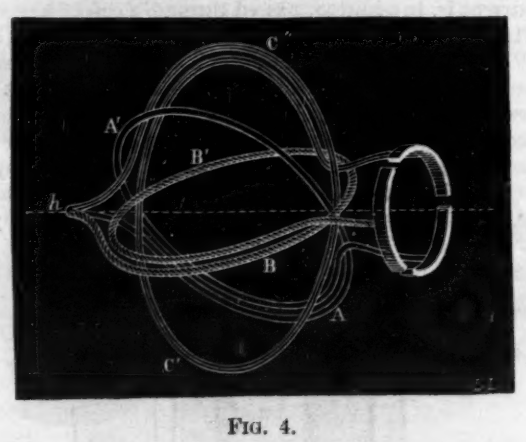


FIG. 4.

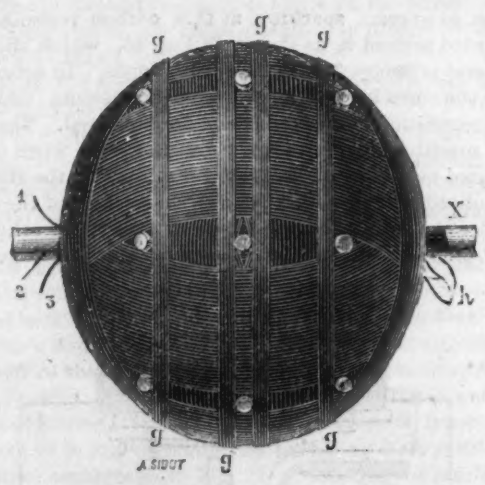


FIG. 5.

commutator, the points at which the various bobbins cross each other being covered with insulating material. It will also be noticed that the crossing of the bobbins increases the thickness at certain points, so that the final shape of the armature more nearly resembles that of a sphere than that of the original core.

In order to explain the action of the machine we must refer again to Fig. 4, which shows the armature in skeleton. It will be noticed that the two opposite portions *A A'* of the same bobbin, passing at the same instant before opposite poles, generate currents which combine, consequently the three bobbins may be considered as reduced to their three halves, *A*, *B*, *C*. These are represented in Fig. 6 by three semi-circles at angles of 120° from one another, the ends connected at *h* and to the commutator, as shown.

The brushes are placed diametrically opposite to each other and parallel to the line of maximum effect. By referring to Fig. 6 it will be seen that in such a position, *A* being situated in the neutral line, its corresponding segment will not be touched by the brushes and it will consequently be cut out of the circuit. At the same time *B* and *C* pass under opposite poles, communicate their current to the brushes and are connected in series or tension. When, on the contrary, *A* coincides with the maximum

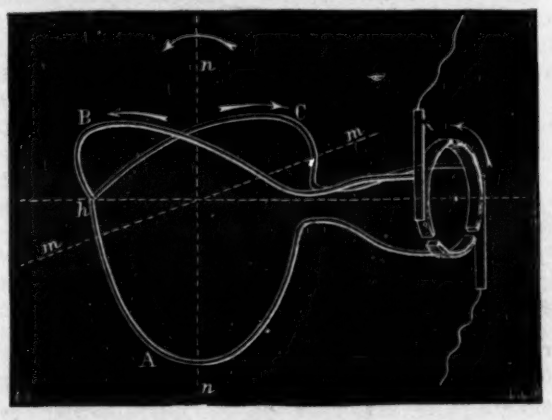


FIG. 6.

line, as shown in Fig. 7, *B* and *C* will pass under the same pole and one of the brushes will simultaneously touch the adjacent ends of their respective commutator segments. At this point *B* and *C* will momentarily be joined in parallel or quantity, and together they will be in series with *A*. An instant later (the armature turning in the direction of the arrow), *B* will be cut out of the circuit, and *A* and *C* united in tension, which action is constantly repeated.

It will be noted that each bobbin is cut out of circuit the moment it traverses the region of small effect, but by means of the simple arrangement shown, the cutting out of circuit of each bobbin takes place at the instant the latter reaches a point 60° from the neutral line; or, in other words, when it has reached a point at which it is no longer important to gather the current.

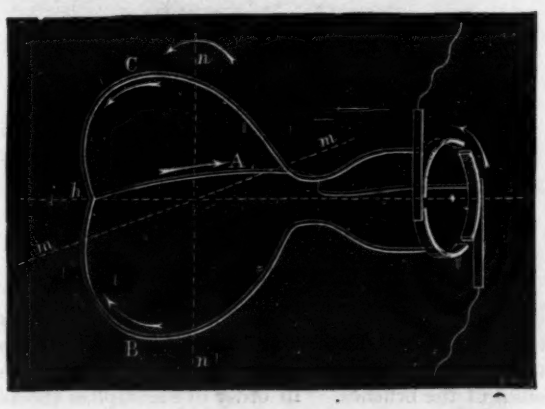


FIG. 7.

Prof. Thomson accomplished this at first by cutting the segments of his commutator so as to leave steps at the ends, Fig. 8, which lap over about 35°. In this way two adjacent bobbins, *B* and *C*, for example, Fig. 7, remain in parallel while the armature passes over an arc of 35°, and the currents generated in *B* during that time are utilized. Another advantage of this arrangement consists in the fact that each brush comes in contact with a bobbin at the moment in which the latter becomes active, and does not leave it until it is almost completely inactive. The spark due to the extra current is consequently considerably diminished.

This form of commutator, although efficient, has been

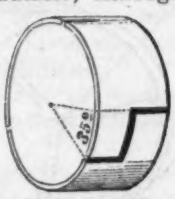


FIG. 8.

replaced by another, in which the segments terminate as usual in simple square ends. The same result is accomplished, however, by substituting two brushes instead of one. Both brushes of each pair are connected together, but the respective brushes are placed so as to touch the commutator at points 35° from each other, which arrangement is obviously equivalent to the first. Our illustration, Fig. 9, shows this in a very clear manner, the bobbins being represented by three straight lines, intersecting the commutator segments.

This figure also shows the neutral and maximum lines in their true position, designated respectively by *n*, *n*, and *m*, *m*. In the position shown, it is easy to see that the arrangement maintains the bobbin *B* in circuit up to the point where it reaches the neutral line.

Prof. Thomson regulates the current of his machine by varying the position of the brushes with respect to the commutator, and he accomplishes this object in two ways.

The first method, which he terms *forward regulation*, is

employed when a diminution of current is required, and consists simply in advancing the position of the brushes a certain distance on the commutator. By referring to Fig. 10 it will be seen that by this means the contact of each bobbin with the brushes is maintained even after it has passed the neutral line some distance. As the current generated in the bobbin after passing the neutral line is in an opposite direction, it follows that, being still in connection with the same brush, it will generate a counter electro-motive force which will tend to diminish the total cur-

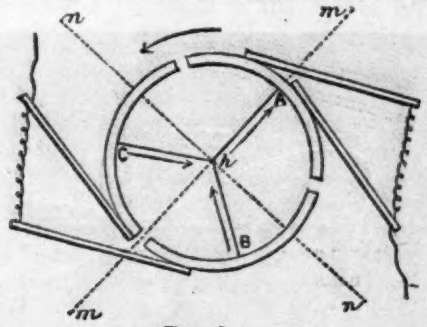


FIG. 9.

rent. The second method mentioned above is termed *backward regulation*, and is that which is now generally applied to this machine. Under normal conditions, the brushes in each pair form an angle of 60° between them, and touch the commutator at points also 60° apart, as shown in Fig. 11; consequently the angular distance between the first of one pair and the second of the other pair of brushes is 120°, *i. e.*, the length of one segment of the commutator. It is evident that with this arrangement none of the bobbins will be cut out of the circuit, since each segment of the commutator will have to pass from one pair of brushes to the other at the instant the bobbin itself is at the neutral line; thus there are always two bobbins in parallel, joined in series with a third.

When the machine is working normally, the position of

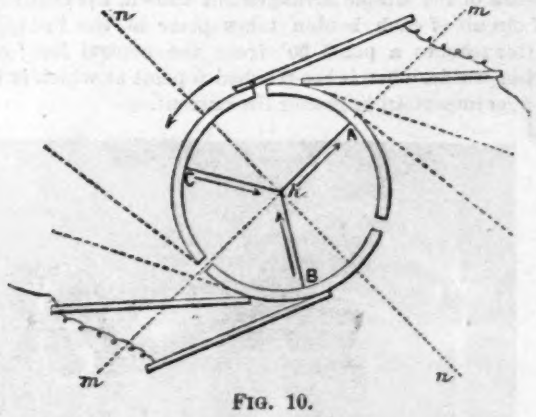


FIG. 10.

the brushes is that just shown; but when a reduction of the resistance in the external circuit necessitates a reduction of tension, it is accomplished by a peculiar movement of the brushes. In order to accomplish the desired result the brushes $F F'$ are given a retrograde motion, while at the same time the brushes $E E'$, Fig. 11, advance a distance three times as great as the former receded, as shown by the dotted lines.

The explanation of the effect produced by this action of the brushes involves a number of considerations; but it is easy to see that if the brushes are spread apart, as shown by the dotted lines, then the angular distance between the pairs is less than 120 degrees. It follows, therefore, that the armature will be short-circuited six times during every revolution by the successive commutator segments. At

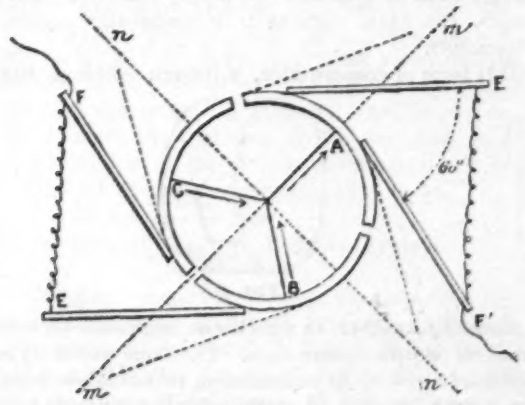


FIG. 11.

every such short-circuit the field-magnet coils alone are in circuit with the lamps, and it would therefore appear as if the latter would be extinguished or fluctuate at such times. This, however, is not the case, and is explained by the supposition that either the self-inductive action of the magnet coils or the reaction coming from the armature furnishes a current which is capable of feeding the lamps during the short-circuit. This supposition seems to be borne out by the fact that when the field-magnets are separately excited the machine no longer acts properly.

The device employed for the purpose of effecting the differential movement of the brushes is shown in Fig. 12. The brush-holders B B are connected to those of B' B' by the lever L vibrating on a pivot so placed that the relative lengths of the lever arms are as 3 to 1.

This system of brushes is operated by a regulator-magnet, supported at one side on the frame of the machine as shown in Fig. 1. The regulator is shown in detail in Fig. 13, and consists of a U-shaped standard U U, carrying the armature A at its lower end. The end of the core of the

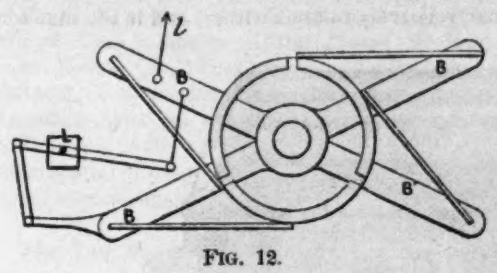


FIG. 12.

electro-magnet is in the shape of a parabola and enters a corresponding cavity in the armature. The proportions are such that the attraction is constant for a given current in every position of the armature within the limits of its movement. The armature has a prolongation A' which transmits its motion to the brush-holders by means of the rod l, Fig. 12. The dash-pot S prevents any violent motion of the lever A'.

If the main current were allowed to pass directly through

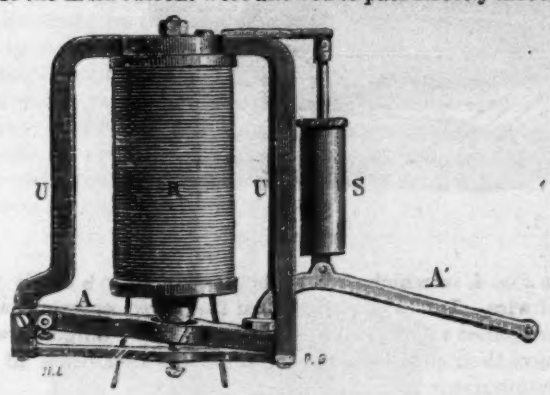


FIG. 13.

the magnet R it would act as a regulator, but its action, as such, would not be sensitive enough. For this reason the current is, in addition, passed through a pair of helices C C, Fig. 14, the cores of which are suspended by a spring S. When the current is of normal strength the cores rest upon a finger at O, which contact completes a shunt of no resistance around the electro-magnet R, and the latter consequently remains inoperative. If the current becomes too strong, however, the helices draw their cores upward and break the contact at O, which sends the current through R, and causes A to move the brushes accordingly. In

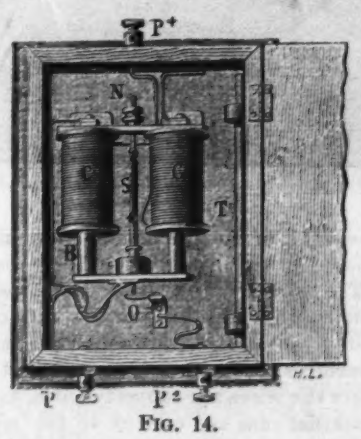


FIG. 14.

order to prevent sparking at O, a carbon resistance T is shunted around it, as shown in Fig. 15, which shows the general arrangement of the entire circuit. In actual practice the cores keep up a continuous movement and effect the regulation as the variations are produced. The Thomson machine works at high potentials, and when oil is to be used on the commutator for diminishing the friction it is noticed that this oil facilitates the passage of the current under the form of an arc from one pole to the other.

Prof. Thomson has introduced into his machine an in-

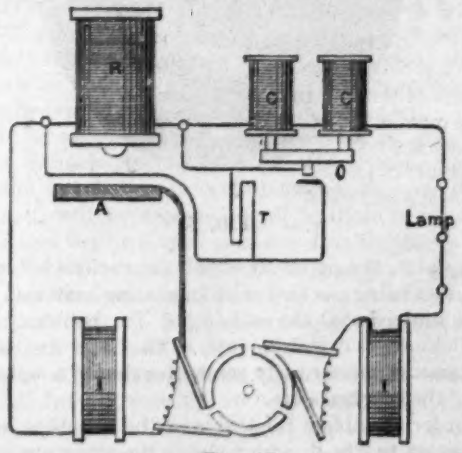


FIG. 15.

genious device for the purpose of preventing the formation of such arc. He has found that in order to accomplish this a thin blast of air directed against the commutator suffices, and that it possesses the additional advantage of permitting the commutator to be freely oiled. Fig. 16 shows the commutator partly in section, while Fig. 17 illustrates the method of applying the air jets, the two nozzles B^3 B^3 being placed opposite to the ends of each forward brush. In the normal position of the brushes a small spark is produced at the ends of the commutator segments, against which the air blast is directed, preventing any injurious action on the former. The blower which furnishes the puffs of air is illustrated in detail in Fig. 18, which shows a transverse section of it. The hub D is mounted on the shaft X and revolves in the

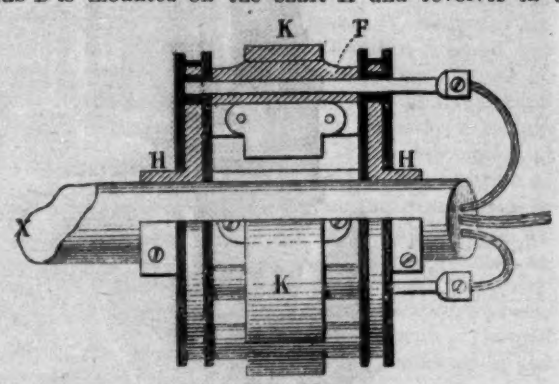


FIG. 16.

centre of an elliptical chamber contained in the piece T, which is supported by the frame of the machine. The hub has three radial slots in which the wings of hard rubber P P P slide freely. During the rapid revolution of the axis the wings are kept against the sides of the oblong chamber and push the air before them, acting in the same manner as a rotary air-blower; O O are the air inlets and Z Z are the outlets which are connected to the nozzles above the commutator. The inlets are covered with wire gauze to prevent the entrance of dust particles, and the hub D is fixed on the shaft in such a position that the jet of air shall be strongest at the moment in which the edges of the commutator pass under the brushes.

The Rights of Exchanges and Their Subscribers.

At Philadelphia, on March 13, as mentioned in our last issue, Judge Biddle granted an injunction restraining the Bell Telephone Company from removing its instrument from Mr. Gibbons' office at No. 230 South Third street. It

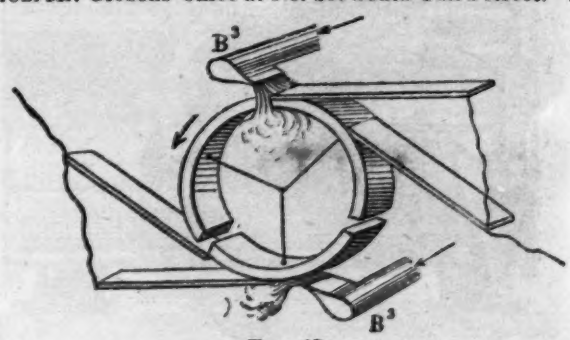


FIG. 17.

was shown that in December, 1881, Mr. Gibbons contracted with the company to pay them $100 a year for a telephone, in consideration of which they agreed to properly maintain and repair the instrument and wires, and furnish efficient service, "efficient service" being defined as "the best service of which said instruments and wires are reasonably capable." Since Oct. 1, 1884, Mr. Gibbons says the company failed to furnish efficient service, and for five continuous weeks previous to the 25th, he had no use of the telephone whatever. The company disregarded all of his verbal and written notices, and threatened to remove the instrument at once, when he insisted upon making a proper pro rata reduction. In order to prevent the inconvenience and injury to his business of having the instrument removed, he filed a bill in equity, and secured a preliminary injunction.

On March 21 the matter came up for argument, and

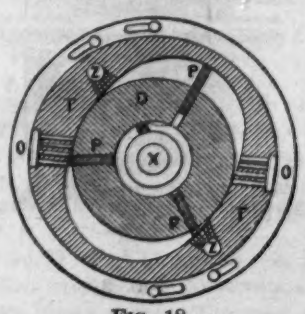


FIG. 18.

Judge Biddle dissolved the temporary injunction, the judge deciding that the plaintiff had no standing in the case, as he had not complied with the terms of the contract. He further remarked that Mr. Gibbons wanted the telephone service and the company wanted his custom. This being the case, he would dissolve the injunction, with the understanding that the telephone should stay in place and that hereafter Mr. Gibbons should pay for it. The rent for the last half year he would not pay, and for this amount the company might sue him at common law and let a jury pass upon the sufficiency of his defense. This arrangeme t was satisfactory to both sides.

The Electric Tube Company.*

UNDERGROUND CONDUCTORS.

(Statement of the Company—edited by the Examiners.)

The essential form of the conductors exhibited by this company is that of an iron tube containing one or more copper conductors insulated from each other and the inclosing iron tube, and having all remaining spaces in the latter filled with an extremely viscous, almost solid, insulating compound, which becomes fluid at a high temperature. This manufactured product is termed an "Electric Tube." These tubes are manufactured in fixed lengths, generally 20 feet. The conductors project from 2 inches to 3 inches beyond the end of the inclosing iron tube, and two lengths of electric tube are joined together by means of copper joints soldered to the projecting conductors and so formed as to allow the expansion of the conductors to take place without injury or danger. Such joints are protected by a cast-iron box completely inclosing them and securely fastened to the ends of the tubes inclosing the conductors. This box is then filled with the same compound as the tube and hermetically sealed.

The exhibit of this company showed the great range in the size and number of conductors which the fundamental form of cased conductor permits, and the great flexibility in making circuits of complicated ramifications, which is given by the plan of having joints at frequent intervals; and the methods of making these joints.

To illustrate the range in size, etc., samples of electric tubes were shown containing conductors varying in number and size, from a single round conductor 1.61 inch diameter, of 2,592,100 circular mils. or 2.036 square inches sectional area, in an iron tube 2⅞ inches outside diameter, to 271 wires No. 14 Brown & Sharpe gauge, of 4,100 circular mils. or .00322 square inch sectional area, in an iron pipe 3¼ inches outside diameter.

To show the manner in which circuits of a complicated character may be made with this form of conductor—circuits such as those used for incandescent lighting on a large scale, having a large number of derived circuits with conductors of widely differing sizes—there was exhibited a portion of an underground circuit such as is used in T. A. Edison's 3-conductor system of incandescent lighting—a system using tubes of which the cross section is shown by Fig. 1.

The exhibit consisted of, first: a "Junction Safety Catch Box." This is a large round box, the top of which is flush with the surface of the street; it is provided with a loose outside cover, and a lighter inside cover bolted down to make a water-tight joint with the box; these being removed, disclose the internal electrical connections in a readily accessible position, 6 inches below the surface of the street. The central portion of the box is occupied by the "Pole Pieces," consisting of as many rings as there are conductors in the system (in this instance three), each ring having as many radial projections as there are tubes entering the box (in this instance six). These projections, which are symmetrically arranged as regards polarity, are all brought to the same level at their extremities and terminate in plane, polished, gold-plated surfaces one inch square, which are arranged equidistant from each other in a circle around the centre of the box. Each of these surfaces has a tapped hole in the centre.

In a circle outside the pole pieces are as many "Safety Catch Joints" as there are conductors entering the box (in this instance eighteen); these safety catch joints are arranged radially opposite the extremities of the projection of the pole pieces; each consists of a copper or composition piece which has a copper rod soldered into it projecting about 8 inches downward into the body of the box, the upper end of the composition or copper piece terminating in a plane, inch-square, gold-plated surface, the same as those on the pole pieces. These surfaces of the safety catch are on the same level as the similar surfaces on the pole pieces, and radially opposite and equidistant from them.

Two feet below the top of the box (that is, the surface of the ground) the electric tubes (in this instance seven) enter the box and are rigidly attached to it, the joint being made water-tight. The pole pieces and the safety catch joints are all insulated from each other, but rigidly attached to a support rising in the centre from the bottom of the box.

Flexible copper cables join each conductor, of each tube, with one of the copper rods which project downward from the safety catch joints, so that by means of flat safety catches placed across from the safety catch joints to the corresponding projections of the pole pieces, all conductors of like polarity are joined together at this point with a safety catch in each circuit in a readily accessible position, where it can easily be removed or replaced. Such a box equalizes the electromotive force at that point of all lines entering it, or if one of the tubes is a feeder, that is, runs back to the dynamos, the box is a distributing point for several circuits which may or may not be brought together again at some other place.

The conductors in the tubes entering this box may be of any size to suit the requirements of the different circuits. The circuits shown entering this box vary from 350,000 circular mils. to 133,000 circular mils. area of conductor, and are arranged to show how they may be laid, bent in different degrees to right and left, joining each other at their extremities; crossing each other and joined together at the crossing; joining other circuits at any point in the length of the latter; reduced in size at any point of their own lengths, and having derived circuits of any size taken from them at any point of their own lengths; and having all those varied connections of different sized conductors made by means of a comparatively small number of standard patterns of connecting joints, boxes covering the joints, and ball clamps attaching the boxes to the iron tube inclosing the conductors.

The ball clamps, in connection with the boxes, are essential features of all underground conductors of this company's exhibit.

Figs. 2, 3 and 4 illustrate the forms of these parts and the manner in which they are used.

Fig. 2 shows the top and bottom halves of a "Coupling Box," a 3-conductor system, and Fig. 3 a "Ball Clamp," while Fig. 4 shows the bottom half of the same coupling box with tubes and ball clamps in place and joints connected. The two parts of the ball clamp being bolted together on the tube, are thus securely clamped to it; the hemispherical parts come together to make a sphere which fits the spherical socket in the nozzle of the box; the two together thus form a ball and socket joint, allowing free angular movement of the tube in any direction, but preventing longitudinal movement of the box on the tube. The angular movement allowed by the ball and socket is limited to any amount in any direction, by providing a rib inside the box (either separate as in Fig. 11, or forming the inside opening of the ball-socket of the box, as in Fig. 2) of such a form that when the extreme amount of angular movement to be allowed in any one direction is obtained, the tube projecting into the box through the ball clamp comes in contact with this rib, thus stopping any further movement in this direction.

The box is made of such size and form that, when the tubes have the extreme angular movement allowed, there is still ample space between the joint and the box to prevent the two coming in contact. Rotary movement of the box on the tube is prevented by means of the small lug on the ball of the clamp which loosely fits sidewise the slot shown in the socket of the box, the slot being sufficiently elongated lengthwise that the lug may have free play in that direction within the limit of angular deviation allowed.

The limiting rib inside the box is made to give the angular movement allowed when the largest size of iron tube that will go into the box is used, but any smaller iron tube may be used in this box (as, for example, in reducing the size of the conductor at this point) by means of a ball clamp, of the form shown in Fig. 5, with a ball to fit the box, but with a smaller semi-cylindrical groove in each half to fit the smaller iron tube. This clamp has in addition, as shown, a semi-cylindrical ring concentric with the groove cast on the ball of each half; the two, when the two halves are clamped together on the iron pipe, forming a cylinder projecting into the box, of the same outside diameter as the largest iron tube that will go in the box. This projection on the clamp, striking against the limiting rib inside the box, limits the angular movement of the smaller iron tube to the same amount as when the largest size of iron tube that will go in the box is used. Therefore the ball clamp and box, as described, while making the iron envelope of the conductors mechanically continuous, and preventing rotary movement of the boxes on the tube, allow an angular deviation (in this case, one in ten) in every direction, at each end of every box, which gives a degree of flexibility to the whole line (in this instance, 11½ degrees at each joint), and at the same time renders it impossible that the joint should touch the box with the extreme amount of angular deviation allowed. The ball clamp, modified as in Fig. 5, also permits the use in any box of any tube smaller than the largest that will go in the box, while preserving the same limit of angular movement.

The flexibility of the whole line thus obtained is necessary for rapid and cheap laying in streets, where, from the number of gas, water and other pipes, sewer manholes, etc., it is impossible to run tubes in a straight line for any distance.

(TO BE CONTINUED.)

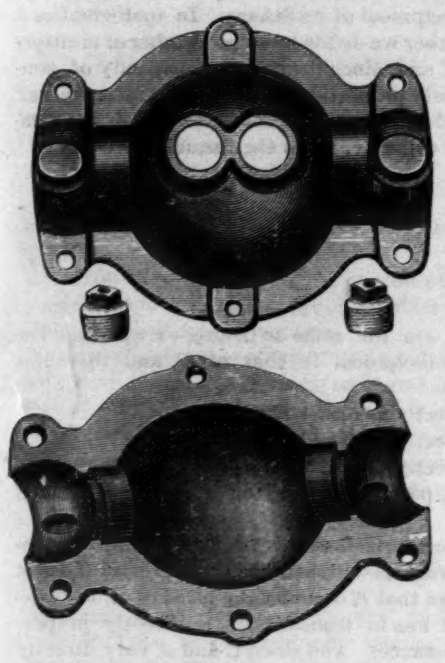


FIG. 2.

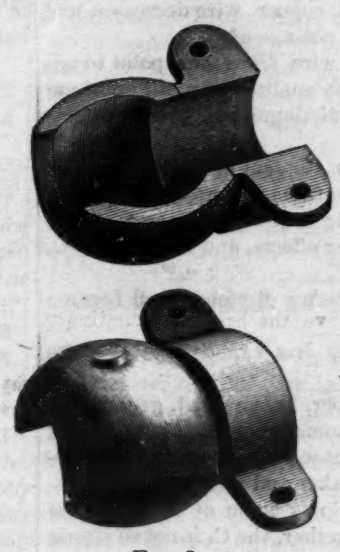


FIG. 3.

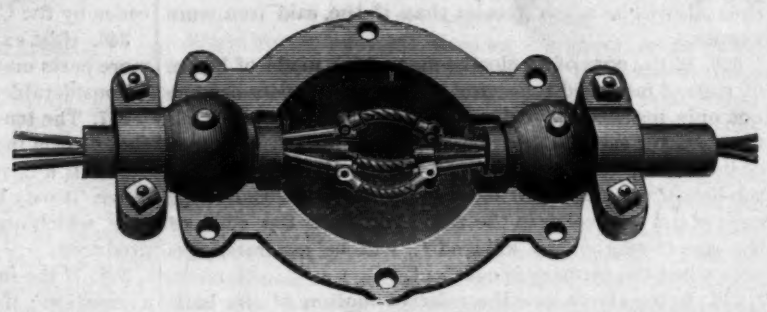


FIG. 4.

FIG. 1.

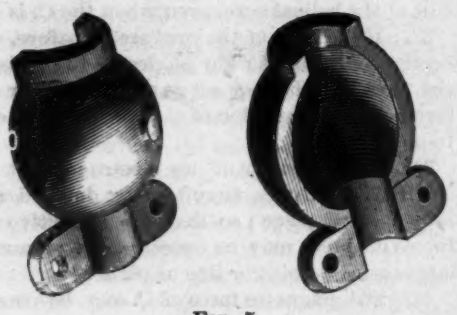


FIG. 5.

* Report of Board of Examiners, Section 18, Underground Conduits, International Exhibition, Philadelphia.

An Analytical and Systematic Method of Inventing.

BY EDWARD P. THOMPSON, M. E.

(*Continued from page* 106.)

The following are a continuation of the principles of science deduced from the experiments of noted scientists, and adapted to be applied to new inventions and to improvements of old inventions, according to rules established in preceding articles:

314. The strength of an electro-magnet may be varied by two or more windings adapted to be cut in or out of the circuit.

315. A magnet provided with two or more helices on the same core, and connected up with two or more independent sources of C., may be varied in its magnetic strength by varying the strength of one or more of the Cs.

316. If the helices are all wound in the same direction, and if the Cs. flow through them in the same sense, the magnetic force will always be increased by switching on the Cs. or by increasing the Cs.; while, if wound in different directions and the Cs. are in the same sense, then will an increase of Cs, or switching on of Cs., cause a decrease in the magnetic force or an increase according to the resultant effect of the Cs. flowing in the various helices.

317. Let a magnetic core be wound with one non-insulated wire, the individual coils and helices being insulated from each other only to such an extent as to prevent actual contact of different parts of the same wire; then will a wire, adapted to connect any two coils or any two helices together, so short-circuit the coils or helices that the result will be equivalent to diminishing the number of coils, while the removal of the wire or the adjusting of it so as to short-circuit a fewer number of coils will be equivalent to adding a greater number of coils to the circuit.

318. The coils thus short-circuited are not completely cut out of the circuit, but are a shunt to the short-circuiting wire.

319. If the short-circuiting wire, or if several short-circuiting wires, each adapted to cut out or throw in a different number of coils or helices, are each passed around an independent magnetic core; or if the C. in the short-circuiting wire is put to some useful purpose, then it is not entirely lost in simply heating the short-circuiting wire or wires.

320. If, in principle 317, the core is wound with an insulated wire, then any number of the coils may be short-circuited or introduced to the full C. by providing the wire at suitable intervals with branch wires, which may be connected at their free ends to the short-circuiting wire.

321. An effect of the introduction of the short-circuiting wire is to diminish the R., so that a greater C. passes through the circuit.

322. As an inverse consequence, the increase of C. at the generator, or at any translating device in the circuit, or from any foreign cause, may serve as a force for automatically cutting out or throwing in one or more coils or helices of the electro-magnet having two or more independent windings.

323. The wire employed to short-circuit the coils need not be cut out of circuit of the C., but may be simply switched from one portion of the circuit to another; so that the cutting in and cutting out of the coils will not be accompanied respectively by an increase and decrease of C.

324. If an electro-magnet be made of soft iron wire covered with electroplated or solidified copper, and the compound wire be covered with an insulating substance, or if the wire employed is made entirely of insulated iron wire, then said magnet will be free from eddy Cs. and be sensitive to rapid reversals of polarity, and yet will be equivalent to an electro-magnet having a core as far as concentration of magnetism is concerned; but the R. of the coils will be much greater than if the said iron were copper.

325. If the core of an electro-magnet be made of layers of coils of insulated iron wire, then will said core become not only magnetic, but it will also become induced with C. whenever there is any variation of C. in the coils proper of the electro-magnet, and when the circuit of the ends of the helical core of iron wire is completed metallically, the coils of the core being in the same planes as the coils of the electro-magnet, an induced C. will be generated, except when the primary is constant.

326. In the above case the relative motion of the helical core and helical magnet will also induce C. in the circuit of the helical core, even when the C. is constant.

327. If the coils of the core are as before, with the exception of being at right angles to the coils of the magnet, then will the core act as a concentrator of the lines of force; but no variation of C. or movement of either will induce a C.

328. The strength of an electro-magnet of whatever nature is due to the circuit being doubled up more or less into a small place; so that the attractive and repelling forces of the C. may be concentrated as much as possible into a central point or line or plane.

329. The magnetic force of C. may be concentrated into a plane by winding or coiling the wire into a flat coil or in the same manner as in a main-spring of a watch or clock.

330. In such an electro-magnet, the north and south poles would be located at points opposite the centre, so that on one side of the flat helix the pole of a compass needle would be attracted, while on the other side the same pole would be repelled.

331. A piece of steel may be charged with permanent magnetism by placing it so as to point toward the north pole.

332. Steel becomes possessed of permanent magnetism by placing it near a conductor of electricity, especially if the conductor is many times coiled about the steel at right angles to its major axis.

333. Steel is converted into a permanent magnet by drawing it along the surface of a second permanent magnet, or along the surface of an electro-magnet, the direction of movement being preferably always symmetrical, and the actual contact not being necessary except for efficiency.

334. By arranging six permanent bar magnets in the geometrical form of a hexagon, and moving one end of a steel bar upon said magnets, the moving bar becomes converted into a permanent magnet.

335. A bar of steel becomes permanently magnetized by moving from its centre the opposite poles respectively of two permanent magnets, both of said poles moving in the same or in different directions. When moved in the same direction the remaining opposite poles should be connected temporarily by a bar of soft iron. For greater efficiency, the movement should be repeated several times.

336. When steel is magnetized by the current, the efficiency is increased by moving the bar in the coil so as to cause a relative movement of the coil from the centre of the bar to one end, then to the other end, and afterwards again to the first-named end, and so on repeatedly, ending with the centres of the coil and bar coincident.

337. Instead of moving the magnet backward and forward, it will become magnetized while in or out of the coil by setting its molecules in vibration by means of a hammer or equivalent, and in all cases the efficiency is increased by the employment of an intermittent current in place of a continuous current.

338. Steel containing about 3 per cent. of tungsten affords a superior degree of saturation and more lasting permanency of uniform strength.

339. By the simple process of hammering, filing, drilling or heating, a bar of hard steel becomes magnetic.

340. Heating, drilling, filing or hammering a piece of soft iron converts it, for the time being, into a magnet (?).

341. A permanent magnet is demagnetized by reversing the movements employed for its magnetization.

342. By one or more of the processes, one or more of the metals—iron, nickel, cobalt, manganese, chromium, cerium, titanium, palladium, platinum and osmium—become temporarily or permanently magnetic, iron to a great and the others to a very small extent.

343. Iron, steel and cast iron have respectively different rates with which they lose their magnetism, so that by grading several magnets, successive motions at long intervals may be produced by the release of a weight or spring from each.

344. These rates depend upon the relative temperatures of the magnetic materials; upon the proportion of carbon, tungsten or other foreign substances; upon the hammering, filing or other cause of vibration of the molecules; upon the angles which their major axes make with the meridian; upon the relative shapes of the magnets; upon the relative weights or strengths of the springs; upon the temper and methods of tempering; upon the pressure at which the magnetic materials were forged or rolled; and upon whether one or more of them were traversed by one continuous C. or by two or more Cs. of different strength.

345. A cutting edge equivalent to a knife, as far as combustible or fusible substances are concerned, consists in the employment of a difficultly fusible wire heated to incandescence by the C.

346. Heat expands and cold contracts, so that two or more parts may be joined and held tight by the force, which is considerable.

347. The tensile strength of copper wire decreases, and that of iron increases, by the passage of C.

348. If a C. passes over a wire from one point to another, it may be invested with qualities of a different nature, which qualities may be distinguished by the effects produced.

349. If the said C. is broken, the fact is made known by a cessation; if it is closed, the fact is apparent; if it is reversed, the fact is disclosed; if the C. is increased, the fact is indicated by its peculiar effects, and decrease of C. is also easily detected.

350. Metal wires cool on being stretched and become heated under compression.

351. Vulcanized caoutchouc has exactly the opposite properties.

352. Metals, especially copper, when bent, generate C.

353. When bent so as to become more and more curved, the C. is more and more intense; when bent so as to become rectilinear, the C. is weaker and weaker.

354. When the wire or strip is made of two pieces of metal soldered or riveted together, the C. is not so strong as if the two metals were one metal.

355. The current in a conductor flows in a direction dependent upon the physical properties of its different parts.

356. Since platinum is a slight absorbent of O., therefore it does not seal a vacuum when passed through the glass.

357. By the passage of a C. through a metal and into a liquid, the former may be either preserved from the destructive action of the liquid or it may be caused to turn into a soluble or insoluble oxide or salt.

358. By making the cathode of metal in a conducting solution not containing a metal, the said electrode is preserved against any possible destructive action of the liquid, and the amount of C. necessary is of very little consideration unless the amount of metal to be preserved be very great.

359. If the electrolyte contain a metal, then will the metallic cathode not be chemically acted upon, but it will become coated more or less with a metal.

360. If a cathode be made hollow, it may be heated by the introduction of steam or any other medium of heat, or, as an example, the steam pipe in a liquid may be preserved from the destructive action of the liquid by making the said pipe a cathode of a secondary cell.

361. If one circuit is in the neighborhood of a second circuit, then, at the instant when a C. begins, or increases, or diminishes, or ceases in the one, a momentary C. is generated in the other, with a strength dependent upon that of the primary C., upon the distance apart of the circuits, upon the Rs. of one or both circuits, upon the rapidity with which the C. is introduced into or removed from the primary circuit, upon the rapidity of increase or decrease, upon the angle at which the circuits stand in reference to each other, upon whether the circuit wire or wires are straight or coiled into one or more helices or electro-magnets, upon whether one or both circuit wires are in relative motion or at rest, upon the direction of the relative motion, upon the velocity of the relative motion, upon the material of which one or both circuit wires are composed, and upon the E. M. F. of the primary C.

(TO BE CONTINUED.)

An Analysis of Ohm's and Joule's Laws.

BY L. R. CURTISS.

$$\text{Ohm's law}—C = \frac{E}{R};$$

that is, the resulting strength of current C is directly as the propelling force E, and inversely as R, the opposing force.

This law is the basis upon which a large proportion of the mathematics of electricity is founded. From the foregoing formula two others are evolved, making three in all, viz.:

1. $C = \frac{E}{R}$, or $\text{ampères} = \frac{\text{volts}}{\text{ohms}}$.
2. $E = C\,R$, or $\text{volts} = \text{ampères} \times \text{ohms}$.
3. $R = \frac{E}{C}$, or $\text{ohms} = \frac{\text{volts}}{\text{ampères}}$;

from which the following rules are derived:

Rule 1. C varies as E and inversely as R.

Rule 2. E varies as either C or R.

Rule 3. R varies as E and inversely as C, that is to say:

a. With C constant, E and R vary as each other.

b. With E constant, C and R vary inversely as each other.

c. With R constant, C and E vary as each other.

These rules apply to all problems involving the three factors C, E and R, and the rules of proportion will readily find the value of either, if the other two are given.

A conductor of given length and area continues to offer the same resistance whether the current is great or small (if we omit the slight variation of conductivity due to heat), hence those rules that refer to a varying R apply to mathematical or experimental cases where R can be varied at will. In applying these rules to the distribution of a current, we have to deal with the subject of conductivity, which is the reciprocal of resistance. In mathematics it matters not whether we divide by some number or multiply by its reciprocal, and, since the carrying capacity of conductors is inversely proportional to the resistance, we can in an inverse order replace R by its reciprocal A, the symbol for carrying capacity, when the formulas become

$$C = E\,A$$
$$E = \frac{C}{A}$$
$$A = \frac{C}{E}$$

which formulas are the same as before, except that the function of A is reciprocal to that of R, and the rules are:

1. C varies directly as either E or A.
2. E varies directly as C and inversely as A.
3. A varies directly as C and inversely as E; that is to say, A, if varied, permits the varying of C directly and E inversely.

If H for heat or loss be inserted in place of and reciprocally to A, the formulas will then be identical with those of Ohm's law, except that H occupies the place of R, thus demonstrating that loss in transmission is directly proportional to the resistance. And since C and A vary directly as each other, it follows that by varying A, C can be varied in the same direct ratio, while loss remains constant.

Again, A varies directly as C and inversely as E; hence, by increasing E and diminishing C in the same ratio, we will have diminished A by a double ratio, without varying the product of $C\,E$.

These rules and the formulas from which they are derived, together with those of Joule's law, are the electrician's *vade mecum*, and the number of examples wherein they are indispensable could be extended almost indefinitely.

$$\text{Joule's law}—\text{Energy} = C\,E.$$

The product of the E. M. F. and the current strength constitutes the energy conveyed.

If we take the second equation of Ohm's law,

$$E = C\,R$$

and multiply by C, so as to equalize the first term with Joule's formula for energy, we have:

$$C\,E = C^2 R$$

or again, if we take Ohm's law of

$$C = \frac{E}{R},$$

and multiply both sides of the equation by E, for reasons last stated, we have:

$$C\,E = \frac{E^2}{R}$$

thus securing three energy equations, viz.:

$$\text{Energy} = CE = C^2 R = \frac{E^2}{R}$$

and the rules are:

1. Energy varies as either C or E.
2. Energy varies as either C^2 or R.
3. Energy varies as E^2 and inversely as R. That is to say, the energy conveyed is proportional to the product of the electromotive force and the current strength, or to the product of the resistance multiplied by the square of the current strength, or to the quotient of the square of the electromotive force divided by the resistance.

To convert these formulas into those used for the rate of working requires the factor time, or t, whence our energy becomes work, or J, and we have:

$$J = CEt = C^2Rt = \frac{E^2}{R}t,$$

or work = ampères × volts × time, or ampères² × ohms × time, or $\frac{\text{volts}^2}{\text{ohms}}$ × time. And since that portion of the work done in overcoming resistance assumes the form of heat, we can substitute H for J, when the resulting formulas become heat equations.

If we wish to eliminate t from these equations, our current C in the first two becomes coulombs Q, and then:

$$H \text{ or } J = QE = Q^2R.$$

Corollary—now, since it is demonstrated that electrical energy is the product of $C \times E$, we can find, by referring to Rule 3 under Ohm's law, that R varies directly as E, and inversely as C. If we vary E and C in an inverse ratio, their product or energy remains unchanged; but this process gives R a double variation in the same direction as E. This explains why by varying E at its source we can vary the resistance by the rule of direct squares.

This much-vexed problem can be still more simplified by assuming values of, say, $C = 3$, $E = 12$ and $R = 4$, when Ohm's formula of

$$R = \frac{E}{C},$$

if expressed by simple arithmetic, reads:

$$4 = \frac{12}{3}$$

(The energy of this equation by Joule's law is $12 \times 3 = 36$) Now, both terms of any equation must vary alike to preserve the equality (R varies as E); hence by doubling 12, the 4 must be doubled to maintain this equality, when

$$8 = \frac{24}{3}$$

Again, by halving 3, the denominator of the second term (in order to restore energy to 36), we must double the first term (R varies inversely as C), to preserve the equality of the equation, then:

$$16 = \frac{24}{1\frac{1}{2}}$$

wherein energy is unchanged, E is doubled and R quadrupled.

This final varying of R by the process of direct squares is equivalent to varying the size of conductors reciprocally, or by the rule of inverse squares.

By remembering that energy is the product of $C \times E$, and by applying the rule "R varies as E and inversely as C,' either of the three formulas of Ohm's law will produce like results, and by remembering also that C and E are analogous to mass and velocity in mechanics, and that velocity is irrespective of mass, these same formulas will furnish the rules for all divided circuits.

Dr. Ochorowicz's Loud-Speaking Telephone.

We learn from our contemporary, the London *Electrician*, that the new thermo-microphone system devised by Dr. Ochorowicz consists of two instruments, which are described as follows:

The magnetic receiver differs from all other apparatus of its kind: (1) By the employment of two vibrating plates equally polarized by the same magnet, and embracing the two extremities of the coils; (2) by the mode of attachment of the telephone case which, instead of being rigid, also vibrates, and is fixed only by means of the second vibrating plate. An examination in detail demonstrates the perfect utilization of the magnetic field and the absolute concordance of the vibrations of every part of the system. The thermo-microphone is, it is averred, the most powerful of all the telephonic transmitters. It reproduces sound in a loud tone even when the speaker is some distance from the instrument, while music and song can be so transmitted so as to be heard by a large number of people. The microphones with which we are acquainted may be classified as follows: (1) The Edison, which embraces all the transmitters acting by *pressure;* (2) and the Hughes, comprising all those which act by means of vibrations, and which always have a certain number of carbons, variously disposed. The thermo-microphone occupies an intermediate place, being acted upon partly by vibrations and partly by pressure. The principal feature of the system, however, is the introduction of heat. Generally speaking, all microphones are more or less heated during action, and the thermal effect increases their sensibility; but there is one great disadvantage attending it—the heat renders the apparatus irregular. The difficulty has been to regulate the instrument so as to allow for the generation of heat and guard against its disturbing influence. The action of the microphone is, as has been said, irregular; its resistance is then almost nothing, but from the moment that a current of 18 to 20 milliampères passes through it, it becomes heated, its resistance is augmented (to about a mean of 200 ohms), and the apparatus will be found regulated for transmission. Under these circumstances it is evident that the exterior temperature will assist or impede the effective working of the transmitter; but by the application of a layer of insulating material in the interior of the microphone itself Dr. Ochorowicz has been able to maintain a temperature of from 13° to 39°, which is sufficient for all practical purposes. At the conclusion of the paper the thermo-microphone, actuated by five Leclanché cells, was placed in a room on the third floor of the building, and the receiver upon a table in the conference room, some 50 metres distant. The result seems to have given great satisfaction, the articulation of the instrument being so distinct that the three hundred members of the society were enabled to hear it with perfect ease.

We add to the above a description of the receiver which was illustrated recently in *La Nature*, and is represented in the accompanying cut. The receiver is the same in principle as that of Bell. The magnet is formed of a hollow steel

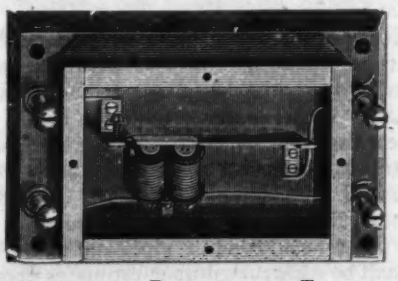
DR. OCHOROWICZ'S LOUD-SPEAKING TELEPHONE.

cylinder, with a slot on one side from five to six millimetres wide. To the centre of this cylinder are attached two little cores of soft iron, on which are wound the bobbins. These bobbins are inclosed between two discs of thin sheet-iron. The lower plate, which is fixed firmly to the magnet, has two holes which freely allow the passage of the iron cores. The magnetism keeps the box in a state of tension. This receiver, with the peculiar transmitter of Mr. Ochorowicz, allowed speaking, singing and music to be heard throughout the hall of the Paris Geographical Society, a hall accommodating five hundred persons.

Automatic Resistance Reducer for Telephone Lines.

When a number of telephones are connected in series on a single line, as is the case in the "individual call" system, the added resistance of the line, due to the call bells of each instrument, affects the conversation very appreciably and soon puts a practical limit to the number of instruments which can be worked advantageously in such cases. Several attempts have been made to overcome this trouble, with varying success. A very simple and effective arrangement, however, has recently been patented by Messrs. Wright & Fisher, of Petersburg, Ill., which is calculated to attain the desired object, and with very little added expense or complication.

In order to reduce the resistance of the line by shunting out the call bells of the successive telephones, an auxiliary magnet of small resistance is used which is capable of attracting its armature only when the comparatively strong calling current from the magneto passes through it. At other times, such as when conversation is being carried on,



AUTOMATIC RESISTANCE REDUCER FOR TELEPHONE LINES.

the armature, being mounted on a light spring, presses the latter against the screw stop shown to the right in the accompanying cut, and closes a shunt around the bell magnets, the weak current required for telephonic transmission not being able to raise the armature from the stop The current will therefore be considerably increased, as the resistance of the auxiliary magnet shown is but a small fraction of that of the bell magnet.

When the calling current is sent over the line, however, its intensity is such that it lifts the armature and breaks the contact at the screw. The consequence of this is that the current is now obliged to pass through both bell and auxiliary magnets, since they are now joined in series, whereas before they were in parallel.

It is evident that by this means the "calling" is not interfered with, and that as soon as the calling current ceases the corresponding magnets are short circuited by a comparatively low resistance.

The Career of a Leading Electrician.

Dispatches from Chicago state that Gen. Anson Stager, the well-known electrician, lies dying at his residence in that city. His career has been a remarkable and eventful one, covering the whole range of American telegraph history and embracing the later developments of telephony and electric lighting.

Gen. Anson Stager was born in Ontario County, N. Y., in 1825. His father was a manufacturer of edge tools at Rochester, N. Y. When 16 years of age he engaged in printing, under the instruction of Henry O'Reilly, who afterward became a pioneer in the building and operating of telegraphs. O'Reilly induced young Stager to follow him into this undeveloped enterprise, and when he had connected Philadelphia with Harrisburg, the young man took charge of his first office at Lancaster, on this line, in the fall of 1846. A little l ter he was called on to Cincinnati. To him is due the credit of first economizing batteries by working many wires at the same time from the same source, on a closed circuit. This was in 1850. He also connected long lines, and so saved time and risk of repetition of messages.

While still acting at Cincinnati, the New York & Mississippi Valley Company's lines, connecting Buffalo, N. Y., with Louisville, Ky., were projected, and Anson Stager was made the first general superintendent thereof in 1852. In July of the same year, through the absorption of the New York State Printing Telegraph Company's lines by the Mississippi Valley Printing Telegraph Company, Gen. Stager's supervision was extended over that State. Soon after this he was prominent in organizing the various lines and interests leased by and consolidated with the Western Union Telegraph Company, and upon the organization of that company he became its general superintendent. The extensive and elaborate system of railroad telegraphs in use on all the railroads in the West and Northwest owes its origin largely to him.

When Fort Sumter was fired on the governors of Ohio, Indiana and Illinois took possession of the wires in those States for military purposes and at once put Gen. Stager in charge of them as representing themselves. He accompanied Gen. McClellan in his West Virginia campaign, during which he established the first system of field telegraphs used during the rebellion. When Gen. McClellan was transferred to Washington he called Mr. Stager to that department to organize the military telegraph. This he accomplished and remained in charge until November, 1861, when he was commissioned captain and assistant quartermaster, and, by order of the Secretary of War, was appointed chief of the United States Military Telegraph throughout the country. Subsequently he was commissioned colonel and aide-de-camp, and was also placed in charge of the cipher correspondence of the Secretary of War. The cryptography used in this correspondence all through the war, which baffled the most persistent efforts of the rebel telegraphers and officers to translate, was in all its details his. Col. Stager remained in the service until September, 1865, and was breveted brigadier-general for valuable and meritorious services.

Following the close of the war, the consolidation of the Southwestern and American telegraph companies with the Western Union made necessary a reorganization of the latter, and the general superintendency of the consolidated company was offered to, but declined by, Gen. Stager. A result was the creation of three grand divisions, the Central, Eastern and Southern, Gen. Stager accepting the superintendency of the Central, which left him in charge of his old territory, with headquarters at Cleveland. Four years later Cleveland became no longer a central point, and during the summer of 1869 the headquarters were transferred to Chicago. After going to Chicago he became the leading Western representative of the Vanderbilt interests. Seeing the opportunities offered by the electrical developments of the time, he helped to found the Western Electric Manufacturing Company, now the largest manufacturers of electrical machinery in the United States, and continued to be its president until Jan. 1 of the present year. Gen. Stager has been prominently identified with the development of the telephone business in Chicago and the Northwest. He also took a prominent part in the introduction of the electric light, and has been the president of the Western Edison Electric Light Company since its formation. Railroads also received a great deal of attention at his hands. Gen. Stager was married Nov. 14, 1847, to Miss Rebecca Sprague, of Buffalo. He lost his wife Nov. 22, 1883. Of his children only three are living—Mrs. F. S. Gorton, Mrs. Ralph W. Hicks and Miss Ellen Sprague Stager.

The Advantages of a Dry, Warm House.

To the Editor of The Electrical World:

SIR: For some two years or more Mr. George B. Sweeser has observed at his residence a sensation similar to an electric shock, at times followed by a spark or crackling noise, like that heard when two poles of a battery are connected, when taking hold of a chandelier to turn on the gas, when opening a register, or closing one—at times so severe as to make it painful to do so.

The hot-air pipes or gas fixtures are in no way connected with any wires that could cause this, there being no wires leading to his house, or running near it, that might lead to

the solution of this matter, on the hypothesis of leakage or defective grounds.

The gas main is reached and brought in from a street that has no telegraph or telephone lines on it.

The house is warmed from a common hot-air furnace, situated in the basement of the house, and there is no building within from 100 to 200 feet of it.

In what way can you account for the electrical manifestation?

I have examined the location of the building with regard to our wires, and in no way can I see a possibility of there being in any way the remotest cause for an electric shock.

J. A. ANDERSON,
MARION, Ind. Manager Central Union Exchange.

Kansas City Items.

To the Editor of The Electrical World:

SIR: Some of your enterprising electrical companies from the East ought to come out here and start a branch establishment in Kansas City. This is the natural distributing point for all the Southwestern States and Territories. Kansas City has more lines of railroad diverging from it than any other city of its size and population in the world. There is no electrical supply company nearer than Chicago. The Western Electric Company of that city, it is true, can furnish anything in their line, but freight is high from Chicago to this point, and it often happens that the different railroad and telegraph companies are in need of something which they do not care to wait for until it can be received from Chicago. We have several locksmiths and bell-hangers who do electrical work on a small scale, but what is wanted is a firm with energy and capital who will manufacture these goods here and keep always on hand a good supply for the demands of trade. There is room and work here for such a company, and they would be sure of a fair business and patronage.

The *Daily News* of this city has the following in reference to a new motor and appliances for running street cars by electricity:

"Three months ago a young electrician, Mr. J. C. Henry, interested a number of well-known gentlemen of this city in his new invention, an electric street railway motor. Messrs. Theodore S. Case, William Kendall, John H. Reid, George Lee, W. O. Cox, Hugh McElroy, Warren Watson, J. Shields, T. J. Van Dorsten, Walton Holmes, Robert Salisbury, of this city, and the Messrs. Chrissman, Roberts and Williamson, from Independence, were quick in perceiving the advantage which such an enterprise would yield, and gave their support to it. A trial of this motor will be made within two or three weeks on the Westport Road, from the Redemptorist convent to Westport.

"A *News* reporter inspected at the Cookson Iron Works the cars and machinery used for this railway. They have been thoroughly tested and found satisfactory. The electricity is generated from stationary power at the central station, the same as it is done for electric lighting. The electrical current is what is known as a quantity current, which means a large quantity but a low pressure. It is considered harmless. The current is transmitted from the station to large copper wires that are suspended immediately over the track. They are guyed in that position from poles at the side of the streets. The street is left perfectly clear. A small light carriage, weighing three or four pounds, travels on this wire and is pulled along by the car as it proceeds. The front end of the car is fitted with an electric motor, the car being always in electrical contact with the generator. This causes the motor to revolve at a very high speed. The motor is in positive mechanical connection with the gearing on the car axle. When necessary to run more than one car this same gearing is extended to the back axle or to the following car. The motor on the electric railway is under perfect control; it can go fast or slow, back or forward, and reverse instantly."

Mr. C. D. Crandall, the secretary and treasurer of the Missouri & Kansas Telephone Company, after an eight weeks' illness of typhoid fever, is again at his desk, looking somewhat pale and weak, but still on deck and daily improving. Mr. W. W. Smith, the general superintendent of the same company, has just returned from Chicago, where he has been to select the latest improvement in multiple switch-boards. The new board will arrive in a few days, and will increase the capacity of central office to 1,200 subscribers.

The Gillis Opera-House, this city, has lately been supplied with an electric light plant of the Fuller system.

KANSAS CITY, March 20. DYNAMO.

A "Novelty Exhibition" for Philadelphia.—From Sept. 15 to Oct. 31 next the Franklin Institute will hold at Philadelphia what is termed a Novelty Exhibition. The display will comprise every possible contrivance coming within the scope of invention and mechanism, and will be similar to the London show of new inventions. Preparations are now making for the event. The committees having the work in charge anticipate no difficulty in getting more than enough novelties to fill the building in West Philadelphia, and as much of the preparatory work has already been done, will have plenty of time to select exhibits and provide for their proper arrangement. If the display should produce as large a revenue as the Electrical Exhibition last year, a handsome fund will accrue to aid in the building of a new hall for the Institute, which is greatly needed. The present building is not only too small, but is objectionable because being frame it exposes the valuable library of the Institute to danger from fire.

WESTERN NOTES.

THE ELECTRICAL WORLD BRANCH OFFICE,
CHICAGO, March 26, 1885.

Messrs. Willoughby, Hill & Co., clothiers, on Clark and Madison streets, prepared some time last year for placing a peculiar style of double lamps on the edge of the sidewalk, at the curb line, on the two fronts of their establishment. The holes were drilled through the pavement, and the posts, thirty feet high, were ready for setting, when an "authority" entered upon the scene and ordered a halt. By a clause in a city ordinance relative to gas, gas lights are permitted at such points, but the posts so used are required to be of the standard form used by the city, and the same ordinance requires the use of a meter. So it was necessary that the city authorities should be asked for a special permit. This petition has been pigeon-holed from that day, until on Monday night, when, amid considerable talk, the permit was granted. A move to reconsider was tabled. This action is unimportant, except so far as it would seem evident that the deadlock is broken, and that hereafter we may hope for a more generous policy on the part of the city fathers toward those who are anxious to aid the city by gratuitously illuminating its business thoroughfares. Messrs. Willoughby, Hill & Co. will have their little light-house beacons up and running at the earliest possible moment, before the action is rescinded.

The Chicago Sectional Electric Underground Company, operating the Dorsett patents, is the only company, so far as I know, which has from the city a general franchise permitting it to go underground with electric light wires. The franchise does not purport, on its face, to be exclusive, but it should be noted that no one else appears to have any luck in getting franchises from the city, and that practically the Chicago Sectional Electric Underground Company would seem to have what is as good as an exclusive franchise for twenty-five years from 1882. There has just fallen into my hands a copy of the form of contract which the conduit company asks the local electric lighting companies wishing to go underground to sign, and I append a few of the most important paragraphs as something likely to interest electric lighting people generally:

"And said party of the second part (the person acting for the electric lighting company) hereby covenants and agrees, that in consideration of the foregoing covenants and agreements to be performed by said party of the first part (the conduit company), he will, on or before said first party shall, in good faith, commence the construction of said conduit from said —— street bridge to said —— avenue, pay to said first party the sum of two thousand ($2,000) dollars, to be applied in the manner hereinafter specified, and that for every five hundred feet of conduit pipe that shall be laid, and as soon as the same shall be laid, in accordance with the provision herein named, said second party shall pay to said first party the sum of two dollars and fifty cents ($2.50) per foot, or twelve hundred and fifty ($1,250) dollars for the five hundred feet so laid, such estimate to be laid by the lineal foot, and to include both main and cross conduit pipes; also, to further pay the sum of thirty ($30) dollars for each man-hole connecting with said conduit, and such sum for the hand-holes so built as shall be just and reasonable, and not to exceed twenty ($20) dollars each, said payment not to include any part of said two thousand ($2,000) dollars. Said estimate to be made as often as five hundred lineal feet of said main and cross conduit pipes shall have been constructed, and the two thousand ($2,000) first herein named to be paid shall be reserved to be applied on the last estimate made upon the completion of said conduits, cross conduits, man-holes and hand-holes between said north —— street bridge and said —— avenue.

"Said party of the second part further covenants and agrees with said party of the first part that in case said last-named party shall be required to build further conduits, man-holes and cross conduits as herein provided, before the commencement of said work said party of the second part shall deposit with said first parties the sum of two thousand ($2,000) dollars, or if less than 800 feet are ordered, then 25 per cent. of the distance to be extended, and shall pay for said conduit pipes and man-holes as fast as they shall be constructed upon estimates upon each five hundred lineal feet of conduit pipe, together with man-holes and hand-holes connected therewith, and in the same manner and at the same rate as provided and agreed upon for said first-named conduit, said two thousand ($2,000) dollars, or amount advanced, to be reserved and applied on the last seven hundred (700) feet of conduit pipe with man-holes that shall be built on any extension so ordered.

* * * * * * * *

"And said party of the second part hereby covenants and agrees to pay to said party of the first part as rent for the use of said conduit and the said connections the sum of not less than six hundred dollars per annum, commencing at the date of delivery of said first-named conduit, and to be estimated as follows: At the rate of one hundred ($100) dollars per annum for each and every mile of each and every wire which shall be placed in said conduits or any extension thereof during the life of this lease, and said payments to be estimated and paid quarterly in advance, but no year shall the rent of the first-named conduit be less than six hundred ($600) dollars per annum; and on every seven-tenths ($\frac{7}{10}$) of a mile of new main conduit that shall be laid hereunder an additional six hundred ($600) dollars per annum rent is hereby guaranteed, or if the new main conduit shall be less than seven-tenths ($\frac{7}{10}$) of a mile then the guaranteed rent shall be *pro rata*, and estimates on wires laid in any new conduit shall be at one hundred ($100) dollars per mile per wire as rent in the same manner as herein provided for said first-named conduit. It is further agreed that the amount advanced and paid to said first party by said second party for the construction of said conduit shall be first applied on said rent, and when the said sum shall be exhausted, then said second party shall pay said additional rent in the manner hereinbefore provided, and any advancements hereinafter made under this contract for the construction of any extension to said first-named conduit shall be applied in like manner upon the wires and the rental therefor that shall be placed in said extension or extensions by said second party.

* * * * * * * *

"It is further covenanted and agreed by said party of the second part that all conduit pipes, man-holes, cross conduits and other pipes connecting therewith, which shall be constructed under this agreement, shall be and remain the property of said party of the first part, with the exclusive right to the possession and control of the same by the said party of the first part at the end of this lease, whether terminated by lapse of time or otherwise."

The contract further specifies that the wires and conduits laid under this agreement "shall not be used for telegraph, telephone, call or messenger service, or for the transmission of messages in any manner."

At a future time I shall probably have something further to say in regard to this matter.

The United States Electric Lighting Company, from their Chicago house, are just completing the following work: Home Insurance Building, 2,000 incandescent lights; Royal Insurance Building, 1,200 to 1,300 lights, incandescent; Northwestern Insurance Building, 500 incandescent lights; Palmer House barber shop, 220 incandescent lights, making some 600 incandescent lights in the Palmer House of the United States style, and from 80 to 90 arc lights.

A daily paper says that the government telegraph offices at Forest City and Fairbanks, Dak., have been discontinued owing to trouble caused by incompetent operators.

The Electrical Supply Company, 175 Lake street, Chicago, have taken the agency for the West for Roebling's telegraph and telephone wire.

From advance sheets of the American Electrical Directory it appears that there are upward of six hundred local electric lighting companies in the United States and Canada. Mexico has eight.

Mr. Sam Uhlich, of Mansfield, O., has organized a local electric lighting company at that place, and the current was first turned on on the evening of the 17th. The Western Electric apparatus is used.

The Milwaukee Electric Manufacturing Company have been making quite a success in Chicago lately of their new electric valve, through Mr. W. C. Temple, Illinois manager. This apparatus, which is designed to regulate the supply of heat to a room by the temperature of the room itself, consists of a thermostat, on the principle of differential expansion, which can be set at any desired temperature at any time, by any one, by means of a small set screw—an "electro-pneumatic valve," which is an ordinary electro-magnet of 6 ohms resistance, and which has attached to its armature a stem operating a tiny pneumatic valve. This valve, though perfectly double acting, has a play of only 1-32 of an inch. The apparatus is really worked by compressed air, which is forced into a tank 12 inches in diameter and 15 feet long, by means of an automatic air-pump driven by water pressure, only consuming from 5 to 10 gallons of water daily. This compressed air is led by means of common ⅛-inch brass tubing to every room in the house connected with the inlet of the electro-pneumatic valve in that room. Now, as long as the temperature in the room is lower than the thermostat is set, the circuit is open and steam is allowed to enter the coils. But the instant the temperature rises one-fourth of 1° over this point the circuit is closed, the electro-pneumatic valve is opened and the compressed air allowed to flow into a diaphragm steam valve in the radiator, and the valve is seated by a positive piston motion and held in its seat by a force of from 100 to 150 pounds. This continues till the temperature falls one-fourth of 1°, when the circuit is broken, the electro-pneumatic valve closes against the compressed air reservoir and opens a vent for the air in the diaphragm valve, which, escaping, allows the valve to open and admit steam till again checked by a rise in the temperature as before. This system seems to remove the greatest objection to steam-heating, and has lately been introduced into the following business places: Ph. Best Brewing Company, Milwaukee; Jos. Schlitz Brewing Company, Milwaukee; State Capitol Building, Madison, Wis.; Baker, Smith & Co., steam heaters; Western Electric Company; *Northwestern Lumberman*, Chicago. Also into the residences of W. B. Judson and J. G. Roche, Chicago, and the Hyde Park School, Hyde Park, Ill.

A singular accident was caused during the G. A. R. celebration in Kansas City last week. A telephone wire running across the street on which the procession was proceeding became loosened and fell within 5 feet of the

ground. A gentleman and his wife passing in a buggy were considerably bruised, and the vehicle badly damaged by coming in contact with the wire. It is supposed that some part of the fireworks struck the insulator, as it was found broken at the foot of the pole.

The principal retail and all of the residence portion of Kansas City lies on an elevation of several hundred feet above the bed of the Missouri River, and what is known as the "bottoms." The cable line runs from the top of this hill to the Union Depot in the bottoms. I understand they intend lighting the viaduct there by electricity, and the effect will surely be splendid.

A correspondent of mine would like to hear from some who have means of observing the practical working of toll lines—whether lines work best east and west or north and south with the same resistance. I believe the theory is in favor of north and south lines, but my correspondent thinks the facts will show differently.

The Hopkins, Pan-Electric and other opposition telephone companies have entirely given up all effort at organization and development in Kansas City.

A hard-working Kansas City electrician has invented a drop for switch-boards that "shuts up" or goes back into position on the insertion of the plug to answer the call. The drop is hung from the top instead of the bottom.

Mr. A. K. Stiles, general manager of the Van Depoele Electric Manufacturing Company, was kind enough to show your correspondent over the plant of the Home Van Depoele Electric Light Company, as the corporation is called, on the evening of the 21st. The plant is located at the corner of Madison and Halsted streets, Chicago, and the company's business is to maintain and rent light to customers on those streets. The dynamo and engine room is a building by itself, specially erected for the purpose, and about 35 feet by 50 feet. It contains two dynamos of the Van Depoele pattern, one a 60 and the other a 40-light machine. Two engines of the New York Safety Steam Power Company's make furnish the motive power, and the boilers were erected by the National Boiler-Works, of Chicago. The building is a picture of brightness and neatness inside. By the way, how much better it is to have the dynamo-room a building by itself, as in this case, rather than to be crowded into somebody's basement. Seventy lights were burning the night of our visit, and the intersection of Madison and Halsted streets was brilliantly illuminated, as were also the streets themselves for quite a distance each way from the corner. The plant is paying very nicely, and would be extended to its full capacity, 100 lights, at once, if the city would allow the company to cross the neighboring streets and alleys with its wires. It would be impossible to calculate just how much the city has hindered the advancement of electric lighting interests in Chicago by the obstacles it throws in the way of the different companies. The hindrances have been such as to cause, in some cases, the entire abandonment of projected plant. The success of Willoughby, Hill & Co., reference to which is made in another part of this letter, after months of effort, may be an indication of a new line of policy on the part of the city, though it is more probable that some other reason could be found for this particular concession. I have referred to the local conduit company elsewhere. Perhaps further information in regard to this whole matter will be forthcoming from this column before long.

The belting of Munson & Co., Chicago, seems to be well adapted for electric lighting purposes. No grease is allowed to remain in the belt from the process of tanning, and there is consequently very little danger from burning should the belt slip. Before being sent out the belts have the stretch practically all taken out of them, and the joints are cemented together, no rivets being used. This belting, I find, is in use by the Western Edison Light Company, Western Electric Company, Van Depoele Electric Manufacturing Company, Sperry Electric Light Company, Thomson-Houston Electric Company, and others. Good belting is as needful as a good engine for a satisfactory electric lighting plant.

A large fire which consumed the Langham Hotel in Chicago, on the evening of the 23d instant, showed a new danger in the electrical field. Upon the roof of the hotel there had been placed a large structure by the telephone company, to which a goodly number of wires were attached. All who have handled aerial wires know the immense tension that is sustained by these frames, which are balanced by diametrically opposed forces, so that in a normal condition the strain is *nil*. In the case mentioned the wires leading in one direction were destroyed and disconnected by the heat, and the strain, coming upon the wall of the structure, pulled a section of it over, with the unfortunate result of burying nearly the whole of the fire patrol crew, who were at work, two of whom were killed and others badly injured.

Mr. Geo. P. Barton, of Chicago, returned on Monday from Syracuse, where he has been engaged before Judge Wallace in the trade-mark case of the Leclanché Battery Company *vs.* the Western Electric Company. This suit was commenced last July, and involves the right of the Western Electric Company, defendant, to use upon batteries of its own manufacture the words "Pile Leclanché," and "Disque," and the particular style of label used by the Leclanché Company, plaintiff, upon the latter's "disque" cells prior to the time the Leclanché patent expired, at which time the Western Electric Company commenced manufacturing Leclanché "disque" batteries, using the same label, and the words "Pile Leclanché" upon the batteries, but substituting its own name for that of the Leclanché Battery Company. There is no dispute as to the facts in the case, the Western Electric Company admitting that when it commenced manufacturing "disque" batteries it simply erased the name of the Leclanché Battery Company from one of that company's labels and substituted its own name instead. This the Western Electric Company claimed it had a right to do on the ground that the matter claimed as a trade-mark is descriptive. The Western Electric Company contends:

1. That the word pile is an English word synonymous with battery.

2. That the word Leclanché has been used simply to distinguish batteries made according to the inventions of Leclanché from other forms of battery, or the Grove, the Daniell, Hoskins, Lockwood and others.

3. That the cuts of the medal are simply a proper advertisement of the fact that the Leclanché battery received a prize at the Paris Exposition in 1878.

4 That the word disque, which in English means disc has been used simply to distinguish a particular form and size of Leclanché battery from other forms and sizes, as the *prism, sealed No.* 1, *and sealed No.* 2. That disque is, therefore, no more a trade-mark than *prism* or *sealed No.* 1.

5. That it was generally known that the patent had expired and that the Western Electric Company, in using the terms by which the battery had been known, did not practice deception, since the label tells nothing but the truth.

The Leclanché Company thinks differently about these things, however, and contends that the Western Electric Company should be enjoined from using "Pile Leclanché" "disque" and the peculiar arrangement of the cuts of the faces of the medal and names and directions printed upon the label, as used by both complainant and defendant.

Judge Wheeler, in New York, denied the motion of the Leclanché Company for a preliminary injunction last August, as appears from his opinion published in the *Federal Reporter*, vol. 21, p. 538. Since then proofs have been taken by both parties, and final hearing was had before Judge Wallace, at Syracuse, on the 20th inst. Defendants' battery is precisely the same as the complainants', and it is simply a question of whether the label and the words and cuts of medals used thereon are descriptive, or whether they improperly indicate the origin of the battery. The decision in this case is looked forward to with interest.

The Van Depoele Electric Manufacturing Company have just organized a local company at Elizabeth, N. J.

The Morton and Comstock Electric Company, of Cleveland, Ohio, has been organized for the purpose of handling the Van Depoele apparatus.

The Van Depoele Construction Company has been organized at Detroit, with a capital stock of $50,000. The company will handle the Van Depoele apparatus in Michigan, including electric light apparatus, both arc and incandescent motors, electroplating machines, etc. The officers are as follows: President, J. E. Wyman; Vice-President, W. B. Hayes; Secretary, W. G. Latimer; Treasurer, C. E. Warner.

Grand Rapids, Mich., is advertising for bids to be submitted by March 30, on 25 electric light iron towers.

Glasgow is to have a Western Electric multiple switch-board, with an equipment for 800 lines and a capacity for 2,000.

The Chesapeake & Potomac Telephone Company is just ordering five miles of 50 and 100 wire Patterson cable for Washington, D. C.

The Bee-Hive dry goods store, Chicago, was fitted up with 30 Western electric arc lights last week.

THE TELEGRAPH.

A Fatal Fall.—At Philadelphia, last week, John A. Lauer, a Western Union lineman, fell from a pole at Howard and Norris streets, and was so badly injured that he died on the following day.

Life Saving Service.—At the close of Congress an item in the sundry civil appropriation bill appropriating $5,500 for telegraph poles and material for the life saving service was dropped out in the enrollment.

Competition at New Orleans.—The Baltimore & Ohio Telegraph Company has opened in New Orleans, La., an office for the transaction of business. This is the first opposition office that has been opened in that city for many years, and a large business is confidently looked for by this rival of the Western Union Company.

The B. & M. Strike.—The strike of the operators of the Bankers & Merchants' Company was of short duration, the receiver inducing the men to return to their work by the promise that they should be paid in full on the 25th inst. This settles the question temporarily, but is considered by many to be merely a putting off of the day of judgment.

Mortgage Foreclosure.—At Boston, on March 23, in the United States Circuit Court, Judge Colt issued an order in the case of Daniel S. Robeson against the American Rapid Telegraph Company so modifying a previous order of the court as to permit the Boston Safe Deposit and Trust Company to apply to the circuit court in Connecticut for the foreclosure of a mortgage on the telegraph company dated Sept. 15, 1883.

Suing for Damages.—W. W. Duffee brought suit in the Mobile, Ala., City Court on the 18th inst., against the Western Union Telegraph Company, for $10,000 damages, as the penalty for failing to deliver a telegram to him for four days. The telegram announced the death of his mother. It was sent from Atlanta the 18th of last December, by Wiley Duffee, a brother of the plaintiff, to this city. The complaint alleges that the plaintiff received no notice of the telegram until the 22d—several days after his mother's burial—although he worked near the telegraph office, and as the messenger failed to find him, he could have been notified sooner through the post-office.

THE TELEPHONE.

The Telephone in Vienna.—By the end of June last the Vienna telephone lines attained a length of 175 kilometres (108 miles). The total length of wire in the cables was 1,300 kilometres (807 miles), and in underground lines, of silicon bronze wire 1 mm. in diameter, 1,683 kilometres (1,045 miles). The number of subscribers was 708, and that of direct connections, 120. In the month of June nearly 52,000 messages were sent by the subscribers, making 1,750 a day. The two central offices are served by 42 girls.

Amherst, Mass.—The telephone company, whose line extends here, evidently does not care for business. When a liberal policy was pursued toward the business men at Milford, the business there, as well as at the central office here, must have paid well. But with the advance of rates from $3 to $4 a month demanded of the Milford patrons, and their refusal to comply, came reduced business here, and the agent being required to guarantee a certain amount, declined so to do longer, and the instrument was removed.—*Amherst Cabinet.*

Affairs in Canada.—A Montreal dispatch says the Dominion Telephone Company is suing the Bell Telephone Company to annul the patents held by defendants and purchased from Blake, Phelps, Andres and Edison. The matter will come before the Minister of Agriculture, as in a former case lately decided by him. A bill to amend the Dominion patent act so as to permit an appeal from the decision of the Minister of Agriculture came up in the Dominion Commons at the close of last week. The question was on moving a second reading. The bill was so vigorously antagonized by Sir John Macdonald and others that the mover, McCarthy, withdrew it on the understanding that the government should introduce a measure facilitating the taking of evidence by the Minister of Agriculture. The proposed amendment to the patent act grew out of the late decision of the Minister of Agriculture against the Bell Telephone Company of Canada, in which the American Bell of Boston has a large stock interest. The debate in Commons indicated that the decision aforesaid was popular. In the course of Mr. McCarthy's remarks in favor of the amendment, he said, touching this case, that application had been made to the Court of Queen's Bench to exercise its ancient jurisdiction and compel the Minister of Agriculture to certify to all proceedings before him. It was one argument against the present state of the law that the Minister of Agriculture could be placed in this not very dignified position.

THE ELECTRIC LIGHT.

Michigan.—A bill has been introduced in the State Legislature to light the Capitol by electricity. There is prospect that it will become law.

Balloon Ascent.—Professor King made a balloon ascension from Philadelphia the other afternoon, and took with him an electric light for use above the clouds at night.

Lighting the "Inventories."—The contract for all the wires and cables required by the Commissioners for lighting the International Inventions Exhibition to be opened shortly in London has been awarded to Messrs. Walter T. Glover & Co., Manchester.

The Fuller-Wood Company.—We understand that a new company of the above name has been organized in this city, and that it succeeds, practically, to the business of the old Fuller Company, controlling also the valuable Wood patents. While the Fuller Company will not pass out of existence, all active operations will be carried on by the Fuller-Wood Company, in which all the principal interests of the old concern will still be prominent, Mr. Geary representing the Appleton interests. It is said that Mr. Chandler will remain a director in the Fuller Company, but will hold no position in the new organization. In order to carry on their own manufacturing, the Fuller-Wood Company have taken a large building uptown, to be occupied as a factory.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 54, a 55; B. & M., b 2, a 3; Mutual Union, b 14; Postal stock, b 1; Postal sixes, b 17, a 19¾; Western Union, b 56⅛, a 57.

Preferred shares of Anglo-American cable stock fell to 48 in London on the announcement of an 8-shilling dividend, against 25 shillings for the previous quarter, and also on reports of a more vigorous war against the Mackay-Bennett cables when the Gould cables are repaired.

Telephone.—Am. Bell, b 223, a 224; Erie, b 21⅛, a 21¼; New England, b 28, a 28½.

The net earnings of the Bell Company for 10 months of 1884 were at the rate of 17 per cent. on the outstanding stock.

Electric Light.—Edison, b 50.

BUSINESS NOTICES.

A Warm Testimonial.—The following speaks for itself:

SALT LAKE CITY, March 6, 1885.

Jerome Kidder Mfg. Co.:

DEAR SIRS: Please forward one No. 4 Office and Family Apparatus, also one of Dr. Tipton's books. I received the others all right. Please send them by express, C. O. D. The apparatus I received for myself is giving perfect satisfaction in my office. I have had no trouble whatever, and if it were impossible for me to get another like it, $5,000 would be no temptation for me to part with it. Yours truly, DR. H. E. GROW.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED MARCH 10, 1885.

Electric Arc Lamp; Warren P. Freeman, New York, N. Y..... 313,487

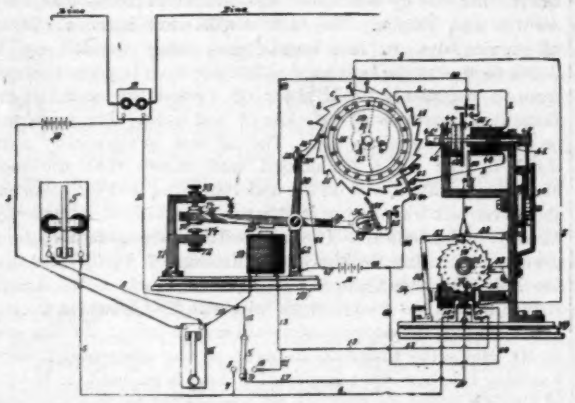
Consist of a rectangular vibrating frame, the side bars of which are made to form armatures for a pair of local magnets, placed transversely between them and supported independently of the said frame, which is pivoted to a stationary central support and in combination with said vibrating frame, and articulated to it by a suitable connecting-rod, a transverse lever, connected with and operating by means of a suitable connecting-rod, a grip-rod for clamping and moving the sliding carbon-holder rod and, in connection with said actuating-lever and suitably attached to it by a connecting-rod, the piston of a dash-pot for governing and equalizing the movement of the working parts.

Dynamo-Electric Machine; Warren P. Freeman, New York, N. Y..... 313,488

Consists of two groups or sets of cores of field-magnets placed on opposite sides of a revolving armature, divided by central polar pieces into two sections each, respectively, and combined with annular end keeper-plates, to which the said field-magnet cores are attached, the said annular keeper-plates rabbeted to receive and hold end bearing-plates, in which is supported the central shaft of the centrally located revolving armature.

Commutator for Dynamo-Electric Machine; Warren P. Freeman, New York, N. Y..... 313,489

It has the commutator strips placed transversely on the periphery of the commutator drum or cylinder, and secured thereto by means of retaining-screws passing radially through peripheral flanges at the sides of the said drum, the screws threaded in the said commutator strips and placed with their heads toward the hub of the said drum or cylinder.



AUTOMATIC ELECTRIC SIGNAL-CONTROLLING APPARATUS. 313,720.

Electric Thermostat; Frederick H. Prentiss, Cambridge, and James A. Tilden, Hyde Park, Assignors to the Automatic Fire Alarm Association, Boston, Mass.. 313,523

Consists of a sealed metallic Bourdon tube containing an expansible fluid of the properties hereinafter set forth, the fixed end of which tube is in constant electric connection with one branch of the open circuit, an insulated electrode connected with the other branch of the open circuit and placed and set in the path of the movement of said Bourdon tube as it straightens under internal pressure produced by the expansion of its contents, and a fluid contained in said Bourdon tube of a character and in a condition to be converted if free at the temperature desired to be signaled by the passage of the current, and at no lower temperature, from a liquid to a gas, whereby the internal pressure on the tube is greatly enhanced at this moment of increment, a greater range of motion is given to the tube, and the closing of the circuit is suddenly effected.

Electro-Dynamic Motor; Frank J. Sprague, New York, N. Y..... 313,546

The electro-dynamic motor has field magnet coils wound in sections, and in shunt relation to the armature, of a commutator and connections, whereby the sections may be progressively thrown into or out of multiple-arc relation with one another.

Regulator for Dynamo-Electric Machines; F. G. Waterhouse, Sacramento, Cal..... 313,561

One or both of the pole-pieces of a field-magnet are connected to the neutral part of the yoke of the field-magnets by means of a set of two or more parallel magnetic arms carrying exciting coils, so that the magnetic strength of each pole-piece will be equal to the aggregate strength of all the arms, and means for varying the current in one or more coils, so that if the magnetism of any one arm is lowered or destroyed, it will weaken the magnetism in the pole-piece by offering a return magnetic path from the pole-piece back to the neutral part of the magnet, through which the magnetism caused by the other arms in the same set may pass without passing through the armature.

Electric Contact Breaker; George S. Maxwell, Louisville, Ky., Assignor to the Cressey Meter Co., of same place..... 313,605

Consists of the combination, with two contact-points, of a pivoted weight, a conducting-piece extending from one contact-point to the other and adapted to be operated by said weight, and devices operated by a meter or other source of power for moving the pivot of the weight, thereby causing the latter to oscillate and operate said conducting-piece relative to the contact-points.

Messenger Signal and Fire-Alarm Apparatus; James J. O'Neill, Boston, Mass..... 313,610

In the present district messenger service system, no provision is made for enabling the person who pulls a signal-box to determine whether or not his call has been received at the central office. The invention consists of a device operated by the signaling mechanism, and actuating the armature, to direct the current from the line circuit through the shunt circuit, and cause the electro-magnet in the latter to hold the armature.

Railway Alarm Mechanism; William M. Pease, Pittsburgh, Pa., Assignor of one-half to Lenox Simpson, of same place..... 313,614

In this invention the alarm mechanisms are actuated from, and the said discs revolve in opposite directions, and the serrations in the two discs are adapted to deliver oppositely reading reports. Thus one disc reports the number 23, and the other disc the number 32, and so on.

Amalgamating Zinc Plates or Bars for Voltaic Batteries; William S. Platt, Waterbury, Conn..... 313,615

Consists in the combination with a zinc bar or plate to be used in a voltaic battery of an amalgam or alloy of mercury applied to said bar in the form of a button or strip.

Clamp for Electrical Purposes; William S. Platt, Waterbury, Conn..... 313,616

Consists of a thin strip of sheet spring metal of good conductivity doubled upon itself and adapted to be loosely connected at its free ends to the line wire and to receive and retain the current wire between its sides, whereby a closer and more rigid connection with the line wire may be established.

Automatic Shunt for Telephone Lines; Charles D. Wright and Charles A. Fisher, Petersburg, Ill., said Fisher Assignor of part of his right to said Wright 313,640

The invention consists in the combination, with a telephone line, of a series of signaling-magnets, and of an electro-magnet and spring for each signaling-magnet, which electro-magnets automatically cut out the signaling-magnets when the reverse current does not pass through the said electro-magnets, and automatically bring the several signaling-magnets in circuit when the signaling-current passes through the electric magnets.

Automatic Electric Signal-Controlling Apparatus; Edwin R. Gill, Jr., Pleasant Hill, Mo., Assignor of one-half to John T. Russell, William A. Symington and James M. Chaney, all of same place..... 313,720

As before stated, a switch *S*, with three anvils or contacts, 8 9 10, is provided. Of these, 8 is intended normally to keep the sounder *S'* in circuit and cut out the magnet 18, controlling primarily the automatic switching apparatus, whenever desired, while 9 and 10 are used to throw 18 into circuit and to normally cut out the sounder, the latter being thrown into circuit whenever, and only whenever, the proper sequence of operations has been performed by the automatic switching devices. If now the switch *S* be placed on 8, the circuit of *B*, controlled as ordinarily and primarily by the relay *R* in the main line, is *B* 4 *K* 5 *S'* 6 7 8 *S* 11 *R B*, in which case all pulsations which pass through *R* will cause the operation of the sounder or other device there located. If the operator or person using the *S'* desire that it be operative only when he alone is needed, he turns the switch to 9. The circuit, the parts being at rest and in their normal condition and relation, as shown, is *B* 4 *K* 12 18 13 14 16 17 9 *S* 11 *R B*. *S'* is now cut out, while the magnet 18, controlling the switching apparatus, is in circuit.

Electric Jewelry; Alfred Haid, Rahway, N. J..... 313,726

In a small open metallic frame or cage is a miniature incandescent lamp. This forms the ornamental head. To this are connected two parallel pins insulated from one another, and connected, respectively, to the terminals of the lamp.

Telephonic Connection; James A. Harlan, Washington, D. C..... 313,731

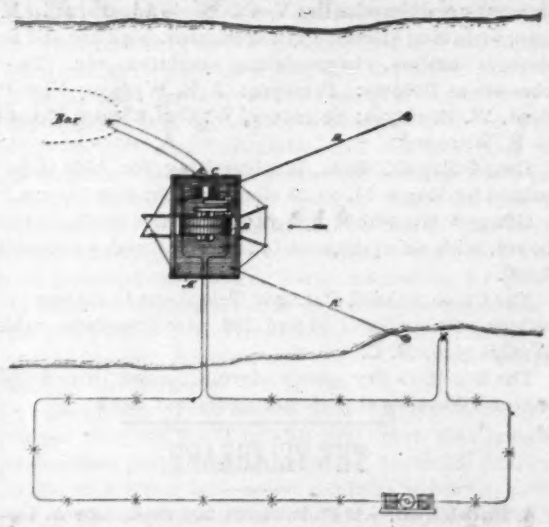
Consists of spring-arms secured to the side of the transmitter-box, which arms carry or operate upon pins or projections, which serve to make the circuit when said projections are forced inward. The normal position of these arms is to break the circuit, the arms being held in such position by the constant force of their adjacent springs, or by a spring force which may be inherent in the arms themselves.

Apparatus for Utilizing the Current Force of Flowing Waters in Producing Electric Currents; Albon Man, Brooklyn, N. Y., Assignor to the River and Rail Electric Light Co., Ohio Co., W. Va.. 313,746

The general working of the apparatus is shown in the figure, wherein the floats are moved by means of cables *R R'*, passing, respectively, from piles driven in the river bed and from a shore-fastening to capstans *F F²* upon the float. These capstans, together with the cables, constitute a warping device, by means of which the position of the floats in the stream may be varied at pleasure.

Electric Illuminator for the Mouth and Similar Purposes; Eli T. Starr, Philadelphia, Pa., Assignor to S. S. White Dental Manufacturing Co., of same place..... 313,782 and 313,783

In the first patent the improvement relates to electric lamp-holders or guards, so arranged with respect to a handle which carries them that the eyes of the operator are protected from the direct rays of the lamp, and consists of the combination, with the substantially flat electric-lamp globe, of a substantially flat casing surrounding it, said casing consisting of two cup-shaped pieces



APPARATUS FOR UTILIZING THE CURRENT FORCE OF FLOWING WATERS IN PRODUCING ELECTRIC CURRENTS. 313,746.

held together at their edges. The objects of the second patent are to improve the construction of the lamp and guard or casing which partially surrounds it; to improve the manner of fitting and connecting the lamp and its guard or casing, and to improve the connections between the lamp and casing and the handle of the instrument by which the lamp is carried, and by which it is manipulated when in operation.

Electric Signaling Apparatus; Jacob P. Tirrell, Boston, Mass..... 313,784

Each movement given to the yoke or carriage *a'* by a semi-rotation of the shaft carries the electrode *f'* from one hole *d'* in the cylinder to the next in the same longitudinal row, causing the electrode to make contact with the cylinder electrode in one hole and stop just before it is moved by the electrode in the next hole (assuming both holes to be provided with electrodes). When the carriage *a'* reaches the point at either end of the shaft *m* where the direction of the spiral groove changes, the shoe *b'* is turned by change in the direction of the groove, and enters the opposite convolutions of the spiral, so that the direction of movement of the carriage is reversed, and the electrode *f'* is moved step by step in the opposite direction along the cylinder; but before the first backward or reverse movement of the electrode *f'* takes place the lever *g* is released by the cam *f*, and causes the pawl *k* to rotate the cylinder one step, thus bringing another longitudinal row of holes, representing the next hour, into coincidence with the electrode *f'*.

Means for Preventing False Signals upon Reversals in Quadruplex Telegraphs; Henry Van Hovenburgh, Elizabeth, N. J..... 313,787

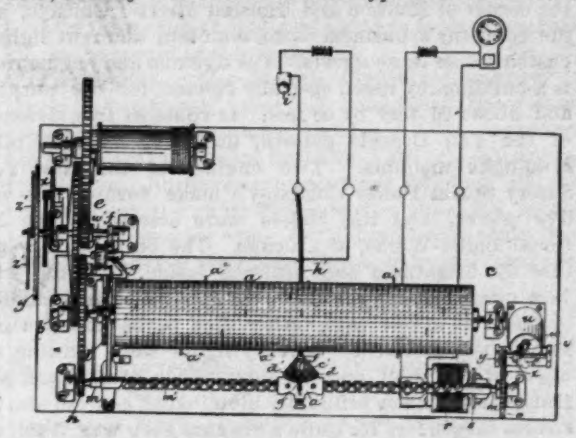
Consists in momentarily neutralizing the local current and actuating the receiving instrument by means of an opposing electromotive force.

Apparatus for Operating Electric Bells; Henry E. Waite and Samuel H. Bartlett, New York, N. Y., Assignor to Charles F. Livermore, Trustee, of same place..... 313,788 and 313,789

The first consists in a magneto-generator, adapted to be operated by a number of door or other pulls and connections, whereby any one of a series of bells or signals may be operated from a single generator, to the exclusion of the others. The second consists of improvements in details of construction upon the first invention.

Printing Telegraph; Henry Van Hovenbergh, Elizabeth, N. J., Assignor to the Baltimore & Ohio Telegraph Co., Baltimore, Md..... 313,786

Consists in mounting two type-wheels of peculiar construction side by side upon two independent arbors, to each of which wheels is secured a scape-wheel and a bevel gear-wheel. The wheels of both systems are in the same axial line. Between the faces of the gear-wheels is placed a bevel-pinion, the teeth of which engage the teeth of both gear-wheels, thereby linking them together. This pinion is carried upon an arbor at the extremity of a wrist crank or arm extending at right angles from one of the arbors, and the three wheels constitute an epicyclic train. The axis of the revolution of the pinion is thus perpendicular to that of the arbor of the type-wheel which carries it, and this arbor is normally revolved in a given direction through the instrumentality of a suitable clock mechanism. A single anchor-escapement, constructed to be actuated in opposite directions through the action of alternate positive and negative impulses transmitted through two suitable electro-magnets, serves as a release for both scape-wheels. The extremity of the polarized armature of a third electro-magnet extends between the two type-wheels, and may be inclined toward one type-wheel or the other,



ELECTRIC SIGNALING APPARATUS. 313,784.

according to the character of the current transmitted through the electro-magnet. When this armature is inclined toward one type-wheel, it projects into the path of a pin carried upon that type-wheel, and acts to arrest its movement at the unison point. When inclined toward the other type-wheel, the armature acts in like manner to arrest the movement of that type-wheel at a corresponding point.

Automatic Chemical Telegraph; Cherrick Westbrook, Harrisburg, Pa..... 313,791

Consists in placing at the respective terminals of a telegraphic main line two batteries, and in equipping the main line with interposed local circuits formed of two multiple-arc branches of the main line. In one of the branches of the local circuit at each station is placed a local battery, in series with the main-line batteries, and in the other branch a receiving instrument is placed. The latter is so connected in circuit that the currents from the main-line batteries are in the wrong direction for operating the recorder. Currents, however, from the local battery will serve to operate the local receiving instruments when not opposed by the main-line batteries. Normally, however, the currents flowing through the main line from the main or terminal batteries counteract the effects of the local batteries and prevent the corresponding receiving instruments from operating. An interruption, however, of the main-line circuit, whether it be made at one or the other of the terminals thereof or at any intermediate point on the line, will cause each of the receiving instruments to be operated by the corresponding local batteries.

Automatic Telegraphy; Cherrick Westbrook, Harrisburg, Pa..... 313,792

Consists in constructing two embossing-points in such a manner that each may be actuated and caused to emboss the paper or foil through the instrumentality of an independent electro-magnet, and in providing a circuit-closing key which, when depressed, will complete a circuit through one of its electro-magnets, and when raised through the other electro-magnet.

Support for Telephonic Transmitters; Henry B. Lytle, Boston, Mass., and John A. McCoy, Baltimore, Md..... 313,828

They obviate jarring of the transmitter by suspending it freely by means of cords or wires, so that it may yield laterally, and these cords or wires they pass over suitable supports above the transmitter, and counter-weight them in such manner that the transmitter may be adjusted vertically in either direction, and so held to suit the height of the person using it, or the convenience of a person desiring to either sit or stand.

Office Connection for Telephone and Telegraph Central Offices; Henry B. Lytle, Boston, Mass., and John A. McCoy, Baltimore, Md..... 313,829

The system consists of office-connections for telephone exchanges, and consists of a series of fixed terminals connected with incoming line-wires, and adapted for connection with other wires, a series of fixed terminals corresponding with those of the first series, and connected with office instruments, and intermediate detachable short conductors connecting the terminals of the two fixed series.

Automatic Circuit Changer and Alarm; William B. Vansize, Boston, and Thomas D. Lockwood, Malden, Mass..... 313,841

The magneto-generator generates an electrical current, constantly reversed in direction. One branch leads to the switch-boards or keys, whereby the current is to be utilized for signaling, and ending there in normally open sub-branches. The other branch leads through the two polarized relays and a resistance to ground, and is a permanently closed or complete circuit. The alternating current therefore flows in this circuit, and, passing through the relays, causes the armatures to vibrate from one side to the other at a rate of speed corresponding to the changes in direction of the current; but as each current (irrespective of its direction) always holds one of the armatures against one of the non-conducting limit-stops so long as any current at all is generated, the armatures are kept in a state of continual motion and the local circuit is not closed; but should the power fail or the generator become disabled, or from any reason the currents cease, the polarized relays become inert and the armatures yield to their bias, and both fall back on the conducting limit-stop, closing the local circuit.